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Effects of Temperature on Snakes [1]

By Francis X. Lueth

Introduction

WELL known is the fact that the activity of snakes, as well as of most other poikilothermous animals, depends upon the temperature. Snakes hibernate when the temperature is low. They retreat to cooler places when the temperature is high. About three years ago it was observed that the amount of food consumed by snakes in the Illinois Natural History Survey collection depended somewhat upon the temperature at which the animals were kept. Apparently the temperature had some effect on the susceptibility to disease. It was observed that, for three consecutive years, the greatest death rate of snakes in the Survey collection occurred about two weeks after a cold snap. The dead snakes had symptoms of lung disturbances. These and other observations led to the present experimental study of the effect of variations in temperature upon snakes.

The snakes used were 52 *Thamnophis radix*, 47 *Natrix sipedon*, 2 *Elaphe o. obsoleta*, and one each of *Pituophis sayi*, *Lampropeltis calligaster*, and *Elaphe vulpina*. A few of these animals were obtained from the live reptile collection of the Illinois Natural History Survey. Additional specimens used were purchased from small boys of the town; others were personally collected by the author. Temperature recording instruments, constant temperature chambers, and other equipment were available at the Vivarium Building, University of Illinois.

Acknowledgements are due Dr. S. Charles Kendeigh for suggestions in the study and for the privilege of using necessary instruments and equipment, Dr. David H. Thompson for permission to use the snakes of the Survey collection, and Louis A. Krumholz for the figures.

Method of Taking Temperatures

To analyze the effects of temperature on animals, it is of course necessary first to obtain a large number of temperature readings. The use of a glass thermometer would require a great deal of handling of the snakes, and as such handling was not desired, it was decided to use a thermocouple and potentiometer instead.

Thermocouples.—All the snake temperatures and many of the air temperatures were taken by means of copper and constantan thermocouples. Thermocouple junctions were prepared in two ways. For obtaining the air temperatures and anal temperatures the thermocouples were made in the form of a thermometer by twisting one wire about the other. The tip was soldered and then insulated with collodion. For obtaining body or "muscle" temperatures thermocouples arranged in the form of a thread were made by soldering the two wires end-to-end and then insulating them. These thermocouples could be sewed like a thread through the skin of the animal into the underlying muscle. They provided a method of taking body or "muscle" temperatures without further disturbing the snake after the initial

[1] Contribution No. 547 from the Department of Zoology, University of Illinois. Awarded the F. H. Stoye Prize at the 1939 meeting of the Society.

insertion. Sewing the thermocouple in the snake proved to be the more practical of the two methods. One snake lived with the thermocouple intact for nine weeks. Examination of a number of snakes at the end of the experiment showed that, in all cases, the thermocouple junction was in the proper position.

Indicator Potentiometer.—A Leeds and Northrup indicator potentiometer was used to obtain most of the temperatures. This instrument is guaranteed to an absolute accuracy of ± 0.25° C. It was read to 0.1° C. Occasionally the instruments and thermocouples used were checked against other thermocouples and a mercury thermometer. In no case was there a difference of more than 0.2° C.

Temperature Under Standardized Conditions

At first, temperatures were taken by inserting a thermocouple into the snake's rectum. The thermocouple would not remain in the rectum for any length of time and it was for this reason that the thermocouple was sewed into the snake. A test of rectal and muscle temperatures was made. An average of five rectal temperatures was 25.00° C. An average of five muscle temperatures taken at the same time was 25.02° C. The difference was well within the possible error of the instrument.

To determine the temperature of snakes under what may be termed standardized conditions, sixty-seven body temperatures were taken when the snakes were in the dark, undisturbed, and after having been kept at constant temperatures for twenty-four hours. Differences between snake and air temperatures were plotted against air temperature. (See Fig. 1.)

The average of the temperature differences (snake temperature — air temperature) between 10° and 30° C. is —0.3° C. Of the fifty-three temperatures in that range, thirty-four are lower than the air, twelve are the same, and seven are slightly higher than the air.

There is an indication that the difference between snake and air temperatures, while nearly constant at medium air temperatures, varies with extreme air temperatures. Certainly the difference in snake and air temperatures below 10° C. and above 30° C. as shown in the figure are outside the range of error of the instrument. The extreme difference at low temperatures seems to be due to an increased heat production. The difference at high temperatures is probably due to an increase in the evaporation of water from the snake.

Effects of Handling

In all cases in which the snakes were handled and temperatures taken, the snakes were warmer than the air. Some temperatures were as much as 2° C. above that of the air. Of twenty-five records taken within two minutes after the snake was handled the snake had an average temperature of 0.9° C. above that of the air. This rise was probably due to agitation and to the absorption of heat from the handler.

Daily Temperature Rhythm

For a study of a possible temperature rhythm in snakes, a recording Micromax potentiometer was used with one specimen. This recorded the snake's temperature every three minutes during the day and night. Cage

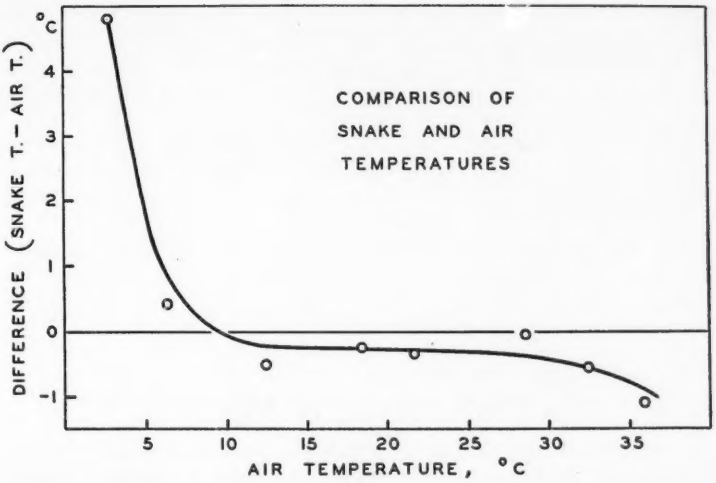


Fig. 1. Difference between snake temperature and air temperature, plotted against temperature.

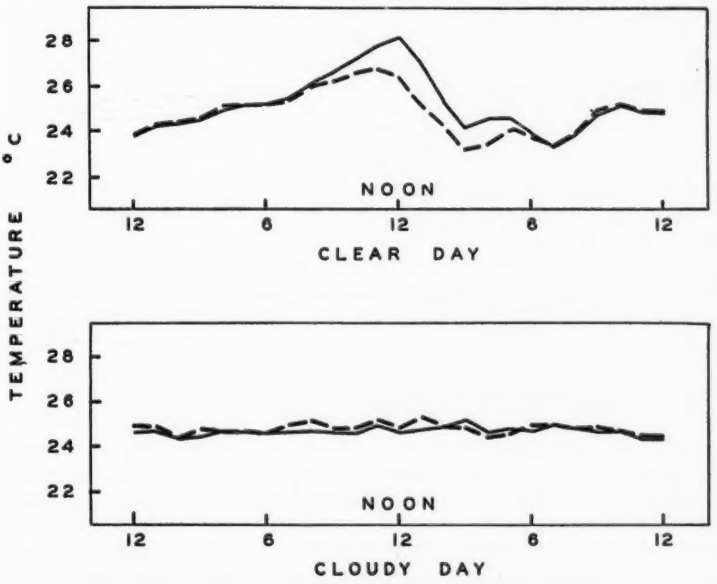


Fig. 2. Daily temperature rhythm on a clear and on a cloudy day.

temperature and room air temperatures were also obtained every three minutes. The instrument used had an absolute accuracy of ± 0.6° C. It was read to 0.1° C. The instrument and thermocouples were checked a number of times during the experiment, and in averages of a large number of records the plus and minus errors should cancel.

A large bull snake was used in this experiment. It weighed about two and one-half pounds. A thermocouple was sewed into the dorsal muscles and then the snake was put into a glass-topped cage and placed in one corner of the Vivarium greenhouse where it would not be disturbed.

After the instrument was adjusted recordings were obtained for almost eight days. To facilitate calculations, the hourly readings over seven days were used. The period chosen was midnight November 14–15 to midnight November 21–22. The average of the 1,960 snake temperatures was 24.8° C. The average of the corresponding cage (air) temperatures was 24.6° C. The snake's temperature, however, was the same as or lower than the cage temperatures during the night and was usually higher during the day.

A rapid rise in temperature of the snake was noted during the first morning of the experiment when the sun was shining directly on the snake. Records were kept and a direct correlation was found between the amount of sunlight and the rise in the snake's temperature.

Temperatures for a clear day and a cloudy day have been plotted to show the difference in snake and air temperatures (see Fig. 2). It can be plainly seen that on the clear sunny day there was a rapid rise in snake temperature and on the cloudy day there were only minor fluctuations. Except for the temperature differences due to absorption of solar radiation, there was such a close correlation of snake and air temperatures that it is evident the snake had no inherent temperature rhythm of its own.

Effect of Temperature Upon the Length of Life of Starved Snakes

Every autumn the snakes of the temperate zones hunt for some place to hibernate. They look for holes, cracks and crevices into which they can crawl. These snakes hibernate singly or in groups and are usually found below the frost line. They go from two to five months without food and come from hibernation weighing almost the same as they did when they "went to sleep" in the fall. The rate of metabolism of cold-blooded animals varies with the temperature. A starving animal burns its own tissues to take care of normal metabolic processes, and when the usable tissue is exhausted the animal dies.

A number of snakes were subjected to various temperatures and the number of days it took for them to die was recorded. The snakes were young *Natrix sipedon,* born in the laboratory between August 18 and September 18. They were weighed and measured on September 28, and the experiment was started September 30. They were from 8.6 to 10.1 inches long and weighed from 3.2 to 4.5 grams. The animals were placed in small containers, either small microscope slide boxes that held five snakes each or metal "pill" boxes that held only one snake each. Cotton saturated with water was kept

in all cages to prevent losses of weight from evaporation; but otherwise the snakes received no water or food during the period of the experiment. The cages were examined twice weekly and the survival time noted (see Table 1).

TABLE 1

NUMBER OF DAYS STARVED ANIMALS LIVED AT VARIOUS TEMPERATURES

	17° C.	27° C.	32° C.	36° C.
	74	43	10	6
	85	43	10	9
	110	43	21	9
	110	47	25	10
	120	50	28	12
	127	56	31	12
				16
Average	104.4	47.0	22.2	10.6

Repeated observations show that a snake loses weight first in the tail and then in the body; so the condition of the snakes was noted as not starved, tail thin, or body thin.

Of the snakes kept at 17° C. all began to show signs of starvation, the tails becoming thin, between the fiftieth and sixtieth day. The body was definitely thinner in those that survived the seventy-fifth day. The dead weight of the snake that died the 120th day was 2.0 grams compared with 3.8 grams at the start. Three snakes shed during the experiment. The last one to die had a few patches of torn skin indicative of trouble in shedding his last skin. None of these snakes ever struck or attempted to escape while being examined.

The tails of the snakes kept at 27° C. became thin between the twenty-fifth and thirtieth day. The body was thinner between the thirty-fifth and fortieth day. Three snakes shed during the experiment. All snakes kept at this temperature were somewhat irritable; often they tried to escape while being examined.

The snakes that were kept at 32° C. and survived the tenth day had lost a great deal of their body weight by that time. These snakes were very ill tempered. They tried to escape when examined and they would often strike. Only one snake shed at this temperature, but it was ready to do so before being placed on experiment.

At the end of seven days, the snakes kept at 36° C. showed signs of loss of body weight. The two that died the twelfth day weighed 2.0 grams each compared with 3.8 and 3.9 grams before being placed on experiment. None of the snakes kept at this temperature shed during the experiment. They had about the same temperament as those kept at 32° C.

Of the snakes weighed after death, all had lost approximately half of their body weight. The experiment indicated that the length of life of starved snakes is dependent largely on temperature. The higher the temperature, the higher the metabolic rate and the shorter the life of the snake. The higher the temperature, the more aggressive the animals became.

Snakes kept alone (one to a box) died at the same rate as those in aggregations (four or five to a box). At the temperatures, and with the number of snakes used, there was apparently no effect upon length of life due to aggregation.

Limits of Temperature Tolerance

During some of the preceding experiments, a few snakes died at high temperatures. As I have seen specimens of *Thamnophis radix* die before they could cross a hot pavement on days when the temperature of the air was over 100° F. (38° C.) and the pavement was much hotter, I decided to test the upper and the lower limits of temperature tolerance.

Garter snakes (*Thamnophis radix*) were collected and used during April, 1939. At least five snakes were used at each temperature. At 37°, 39°, and 40° C. all the animals lived more than 48 hours. Eight snakes died within twenty-four hours after being put into a 42° C. temperature chamber. At least four of these snakes were dead at the end of twelve hours.

The lethal effect of temperatures of 40–42° C. may hold good for only certain species or for certain seasons of the year. A *Thamnophis sirtalis* died after twenty-four hours at 38.5° C. in May, 1938. Two others lived for forty-eight hours at 41° C. in August of the same year. A *Natrix sipedon* died within twenty-four hours at 39° C. in April, 1938, and three others lived for one day at 43° C. in September of that year.

Five specimens of *Thamnophis radix* and forty of *Natrix sipedon* were used in locating the lower limit of temperature tolerance. At — 2° C. and — 5° C. no snake (of fifteen used) lived for more than twenty-four hours. Eight specimens of *Natrix sipedon* were frozen within twelve hours at — 2° C. Aggregation (of five snakes) did not affect the length of life at this temperature. All snakes (thirty) lived for more than twenty-four hours at 1.5° C. and above. One small *Natrix* lived for fifty-six days at 1.5° C. and then, when it was accidentally placed at — 5° C., it was frozen within twelve hours.

Effects of Temperature Upon Captive Snakes

As the experiments reported above were conducted upon captive specimens, the results should apply to almost all captive snakes kept under the same conditions. However, unlike the snakes of the experiments, most captive snakes receive food occasionally, they are somewhat active, and they are subjected to some light during the day. All these factors influence the temperatures of the snakes; so the ordinary captives rarely, if ever, have temperatures as low as they would have under standardized conditions used in these experiments. The relatively constant temperatures of the buildings where most captive animals are kept would keep the snakes from following as great a temperature fluctuation as wild serpents. Yet it would be only in thermostatically controlled cages that snakes would not have some temperature fluctuation.

Snakes should be kept cool if they are to live a long period without food. However, experience shows that few captive serpents eat if the temperature is under 15° C. In February, 1938, when the temperature fluctuated between 15° C. and 20° C., a bull snake was supplied with sparrows; but it ate only two. In July, when the temperature was much higher, this snake ate seven sparrows in two days and fourteen sparrows in ten days. It would have eaten more had they been available.

Results of these experiments and observations covering several years indicate that a temperature of about 25° C. should be suitable for keeping

small snakes. The serpents eat readily at this temperature, but their metabolic rate is not excessive. They are not nearly so susceptible to lung infection at this temperature as at lower temperatures nor are they so susceptible to eye and skin infections as at higher ones. Another advantage of this temperature is that it makes the snakes neither extremely sluggish nor very vicious if handled.

Effect of Temperature Upon Snakes in Nature

In its natural surroundings, a snake is subjected to less constant temperatures than under standardized laboratory conditions. During the active part of the year, the snake is subjected to light during the day; it is more active than the experimental animals; and there is usually some digestion taking place. All these factors tend to raise the snake's temperatures above those of the air.

Even though wild serpents may not be exposed to great temperature changes in a short period, they undoubtedly undergo a daily temperature fluctuation. This is especially noticeable during the early spring. It is during this season that the snakes sun themselves, so that their temperatures are probably raised a number of degrees above those of the air and their own temperatures of the previous night.

The activity of snakes confirms the experiment upon their metabolism at various temperatures. While the snakes can go for long periods without food during the winter, they need huge amounts of food during the warm months.

The nocturnal habits of many of the desert snakes is possibly due to temperature. Few of the snakes can survive temperatures much over 104° F. (40° C.).

A few snakes hibernate relatively close to the surface and may even come out during a warm spell in the winter. However, so far as is known no snake hibernates above the frost line; snakes must hibernate where frost cannot reach them if they are to survive the winter.

Summary

1. The body temperatures of small snakes under standardized laboratory conditions and between the limits of 10° C. and 30° C. average approximately 0.3° C. below the air temperatures.

2. At temperatures between 0° C. and 10° C. the temperatures of snakes become higher than air temperatures. Above 30° C. the temperatures of snakes drop below air temperatures.

3. Although snakes have no inherent temperature rhythms, they have a daily fluctuation in temperature which depends on a fluctuation in air temperature and the amount of solar radiation the animals receive.

4. The rate at which energy reserves are utilized in snakes during starvation varies directly and the length of life varies inversely with the air temperature.

5. The very small loss of weight of snakes in hibernation is due to reduced metabolism brought about by reduced temperatures.

6. There is a positive correlation between the air temperature and the aggressiveness of snakes.

7. The upper limit of temperature tolerance for *Thamnophis radix* in captivity during the spring of the year is between 40° C. and 42° C.

8. The lower limit of temperature tolerance for *Thamnophis radix* and *Natrix sipedon* is approximately 0° C.

9. A temperature of 25° C. is suitable for keeping small snakes in captivity.

10. The body temperature of a snake in nature is probably above that of the air, because it is subjected to factors of activity, solar radiation, and digestion.

UNIVERSITY OF ILLINOIS, URBANA, ILLINOIS.

Notes on Mexican Snakes of the Genus *Elaphe*

By HOBART M. SMITH [1]

WHILE guests of Mr. and Mrs. Eizi Matuda of La Esperanza, Chiapas, my wife and I discovered a specimen of *Elaphe* late at night along a trail in the foothills of nearby Mt. Ovando. This proves to be a relative of *flavirufa*, a species previously known only from the Atlantic coast (except for a nominal record by Cope, Bull. U.S. Nat. Mus., 32, 1887: 71, for "*Chiapas*"). It is not surprising that this specimen presents characters differing from typical Atlantic coast *flavirufa*. It appears to represent an undescribed form, with which it is a pleasure to associate the name of our very generous host in southern Chiapas.

Elaphe flavirufa **matudai,** subsp. nov.

TYPE.—U.S. National Museum No. 110303, female, from Salto de Agua, 1200 ft., Mt. Ovando, 10 kilometers northwest of Escuintla, Chiapas.

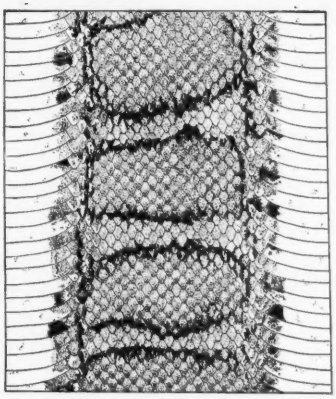
DIAGNOSIS.—Similar to *Elaphe flavirufa flavirufa*, except scale rows 23 posteriorly; 10 supralabials, fifth, sixth and seventh entering eye; 35 dorsal blotches on body, these extending laterally to the third scale row; belly heavily stippled posteriorly, light on anterior third or fourth of body; general dorsal color very dark.

DESCRIPTION OF TYPE.—Rostral somewhat broader than high, its suture with internasals as long as suture between an internasal and nasal; internasals a third size of prefrontals; latter extending onto sides of head slightly; frontal essentially pentagonal, its length slightly less than its distance from tip of snout, which in turn is slightly greater than maximum length of a parietal; nasal completely divided, anterior section subequal to posterior; loreal longer than high, lower edge straight, upper edge curving downward posteriorly, giving loreal a wedge shape; preocular large, in contact with frontal (divided longitudinally on one side); 2 postoculars; temporals 2–3; 10 supralabials, fifth, sixth and seventh entering orbit; 14 infralabials; eye

[1] Walter Rathbone Bacon Traveling Scholar, Smithsonian Institution.

large, nearly round, its diameter (6 mm.) half its distance from tip of snout.

Dorsals in 25-29-23 rows, feebly keeled, with two apical pits; ventrals 258; anal divided; caudals 102; a rounded keel on each side of venter, near ends of ventrals.



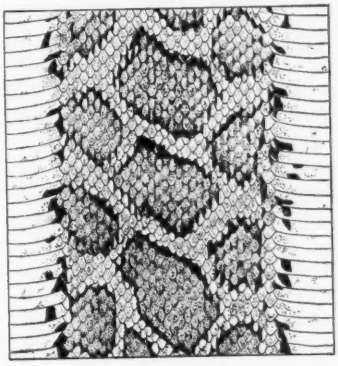


FIG. 1. (left). Pattern of *Elaphe flaviruſa matudai;* U.S.N.M. 110303, section from anterior third of body, from the 54th to the 80th ventral. The pigmentation of the belly is not prominent at this point, but increases greatly posteriorly.

FIG. 2. (right). Pattern of *Elaphe f. flaviruſa;* from a typical specimen, EHT-HMS No. 5373, 30 km. north of El Limón, Tamaulipas. Section from anterior third of body, from the 83rd to the 108th ventral. The pigmentation on the belly does not increase posteriorly. Both figures drawn by Dr. Doris Cochran.

Dorsal ground color gray; a series of 35 very large blotches on body; blotches on tail indistinct posteriorly; blotches gray medially, very slightly reddish, with a black border covering one scale length or less; blotches extending laterally to second or third scale row, medially covering 5 or 6 scale rows, slightly narrower laterally; more or less alternating with these are similar blotches on the sides of the body, not dark-bordered below, a few extending dorsally to the eighth scale row, but most only to the third; in some instances the dorsal blotches have no corresponding alternating lateral blotches; dorsal color extending to lateral abdominal "keel". Venter light, unspotted on extreme anterior part; then with scattered, minute spots of dark pigment which become more numerous posteriorly, so that the posterior half of the belly is mostly dark, with little light color showing; the tail completely dark (gray), except for poorly defined lighter areas near the free edges of the scales. Dorsal surface of head nearly uniform gray, with a few irregular darker flecks.

COMPARISONS.—This form differs from typical *flaviruſa* in a number of respects. In six specimens [2] of the latter examined, the scale rows posteriorly are invariably 21 (23 in *matudai*); the supralabials are usually 9, 9–10 occurring in two (9–9 in others), and the labials entering the orbit are usually

[2] EHT-HMS No. 5373, 30 km. north of El Limón, Tamaulipas; U.S.N.M. No. 6566, Yucatán; No. 6626, Tabasco; No. 14848, Campeche?; No. 24998, Mirador, Vera Cruz; and No. 110302, Potrero Viejo, Vera Cruz.

4–5–6, 5–6–7 entering orbit on one side in two (10–10 labials, 5–6–7 entering orbit in *matudai*); the ventral surfaces are white with scarcely any spots (heavily pigmented posteriorly in *matudai*); dorsal blotches extend laterally to the sixth or seventh row (second or third in *matudai*); the series of lateral blotches is regular, all blotches of about equal height (irregular, numerous blotches nearly eliminated by extensive lateral development of dorsal blotches in *matudai*); and the general ground color is light, with little pigment (dark, rather heavily pigmented in *matudai*).

The essential differences appear to be in the extent of lateral development of the dorsal blotches, and in the pigmentation of the ventral surfaces. The differences in scutellation may not be entirely constant, according to data given by Gaige (Carn. Ins. Wash. Publ., (457) 1936: 299) for four specimens from Yucatán and Campeche, as she records three specimens with scale rows dropping only to 23.

The present form and typical *flaviruja* differ widely from *triaspis,* which has a much smaller eye and only two labials in contact with it.

Elaphe chlorosoma (Günther)

The type of *Coluber mutabilis* Cope (Proc. Amer. Philos. Soc., 22, 1885: 175) from Verapaz, Guatemala, agrees with *triaspis* in all significant characters of scutellation, in relative size of eye, in shape of head and in shape of scales. It also is from an area where *triaspis* is known to occur. It was distinguished from the latter on the basis of pattern differences, and by the presence of three instead of four anterior temporals. The latter character obviously is subject to much variation. The specimen is white (cream), without any markings or pigmentation whatever, save a few, very faint lines on the head. Total lack of pigmentation, rather than a nearly uniform gray color as in adults and subadults of *chlorosoma* (in which the bases of the scales also are black), leads me to believe that *mutabilis* is an albino, referable to *triaspis.* Adult *triaspis,* as stated by Schmidt and Andrews (Zool. Ser. Field Mus. Nat. Hist., 20, 1936: 172–3) retain the pattern without any indication of loss. There were six paratypes of *mutabilis:* one from Guanajuato (U.S.N.M. No. 11354), which is a typical, subadult *chlorosoma*; one from Tehuantepec, probably also *chlorosoma* (not seen by me); one from Costa Rica (U.S.N.M. No. 9777) and four from Guatemala (U.S.N.M. No. 24729–30, 61066), all typical *triaspis* with well developed patterns.

A specimen from El Sabino, Michoacán (EHT-HMS No. 5193), accordingly cannot remain under the name *mutabilis* (Taylor, Kan. Univ. Sci. Bull., 26, 1939: 459–460, fig. 5). Moreover it is not *triaspis,* since it is far removed from the range of the latter and has 57 spots on the body (51 maximum in *triaspis*).

It is my belief that this specimen represents the juvenile pattern of *chlorosoma,* the young of which were previously unknown. In *Elaphe* pattern changes such as are indicated in *chlorosoma* are known in *bairdii* and *quadrivittata,* although in these species the spots are replaced by stripes (which may be faint) in adults. Structurally no constant differences from subadult and adult *chlorosoma* can be discerned in this specimen. Two of the smaller, subadult *chlorosoma* examined (from Guanajuato and Tehuantepec) show a similar, but very faint, spotted pattern (best discerned under water or

alcohol), and the head pattern of the Michoacán specimen is reproduced very faintly in the same *chlorosoma* specimens. Since spotless young referable to the latter species are as yet unknown, there is little reason to maintain as different species these two color phases, at least until evidence is produced showing that they cannot be attributed to differences in age. This conclusion has been reached also by Dr. Taylor, who writes "I have examined the *chlorosoma* specimens and find, as you presume, that the youngest shows spots on the body, and likewise traces on the head of the markings of the specimen I recently discussed as *E. mutabilis*. I believe you are correct in assuming that specimen is the heretofore unidentified young of *chlorosoma*."

A second spotted juvenile, also referred to *chlorosoma*, is Field Mus. Nat. Hist. No. 16161, from Colima, Colima. It is described in my notes as follows: "Female; scale rows 33–35–23; ventrals 267; caudals 98; supralabials 8–9; infralabials 10–10; fifth and sixth labials enter eye on one side, fourth and fifth on other; oculars 1–2; temporals 3–3; maxillary teeth 21 and dentary teeth 24, decreasing in size posteriorly; total length 656 mm.; tail 123 mm. There are 58 gray-brown, dark-edged, median dorsal blotches, extending laterally to about the fourteenth scale row on each side. Two series of similar, rounded spots occur on the sides of the body; the spots of the lower series are very poorly defined. All the markings become indistinct on the posterior part of the body. The lateral edges of the ventrals have small, quadrangular, dark olive blotches."

It is to be noted that the Colima specimen, larger than the one from Michoacán, has a more indistinct pattern.

Elaphe **sclerotica,** nom. nov.

Coluber subocularis Brown (Proc. Acad. Nat. Sci. Phila., 1901: 1–4, pl. 29), known since 1917 (Stejneger and Barbour, Check List: 84) as *Elaphe subocularis* (Brown) is a secondary homonym of *Bascanion subocularis* Cope (Proc. Acad. Nat. Sci. Phila., 1866: 319), a synonym of *Coryphodon mentovarius* Duméril and Bibron (Erp. Gén., 7, 1854: 187). Brown's name is the more recent, and accordingly is here suppressed, in conformance with the rules of the International Code of Zoological Nomenclature.

The nomenclatorial problem in question involves the following considerations: *Bascanion* is a strict synonym of *Coluber*, having the same genotype; *Coryphodon mentovarius* was first placed in the genus *Coluber* by Garman (Mem. Mus. Comp. Zool., 8 (3), 1883: 42, 147), who has been followed by Stejneger and Barbour (Check List, 1917: 78; 1923: 86; 1933: 93; 1939: 102) (by inference), Dunn (Proc. Acad. Nat. Sci. Phila., 92, 1940: 118) and others; although *mentovarius* had been placed in *Coluber* at least once before 1901, when *C. subocularis* Brown was described, its synonymy has never been treated in full by any author who has placed it in that genus; and the actual combination *Coluber subocularis* Cope, 1866, has never heretofore appeared in print, even though inferred.

It is concluded that *mentovarius* may at some time be definitely determined as a member of the genus *Coluber*. It is furthermore possible that its synonym *subocularis* Cope may be revived for some reason, perhaps to denote a recognizable subspecies. At the moment it is revived, or for any other reason appears in the literature as *Coluber subocularis*, in the status of a synonym,

species, subspecies, or any other category, it automatically suppresses *Coluber subocularis* Brown, according to *any* code of Zoological Nomenclature. It is in the interest of nomenclatorial stability and to avoid later confusion that the name is here deliberately suppressed and replaced by a name which, it is believed, cannot again be changed.

KEY TO MEXICAN *Elaphe*

1. No labials entering eye; a series of subocular scales present ..... *sclerotica*
   One or more labials entering eye; no suboculars 2
2. Three labials entering eye 3
   One or two labials entering eye 4
3. Spots extending laterally to second or third scale row, partially eliminating lateral series of spots; belly heavily pigmented posteriorly, tail uniform dark below; 23 scale rows posteriorly ..... *flavirufa matudai*
   Spots extending laterally to sixth or seventh scale row; lateral spots regular, large; belly and tail white; 21 scale rows (usually) posteriorly ..... *flavirufa flavirufa*
4. Scale rows 29 or less at midbody 5
   Scale rows 31 or more 6
5. Adults and subadults unspotted, with broad stripes (sometimes faint); young with over 50 spots on body; head unmarked; subcaudals usually more numerous, 85 to 95 in females, 92 to 103 in males ..... *bairdii*
   Spots present throughout life, less than 50 on body; head with distinct, large, alternating light and dark V-shaped marks; subcaudals usually fewer ..... *laeta*
6. Spotted 7
   Gray, not spotted 8
7. Subcaudals 73 to 109; blotches present and distinct throughout life, 51 or less on body ..... *triaspis*
   Subcaudals 93 to 126; blotches present only in young, 57 to 58 on body. *chlorosoma*
8. Supralabials ten or (usually) eleven, one entering orbit; subcaudals 83 to 88 ..... *rosaliae* [2]
   Supralabials eight or nine, two entering orbit; subcaudals 93 to 126. . *chlorosoma*

U.S. NATIONAL MUSEUM, WASHINGTON, D.C.

The Status of *Uta schottii* Baird [1]

By M. B. MITTLEMAN

THE status of *Uta schottii* Baird, 1858, has remained obscure since the time of its original proposal. Thus, Yarrow (1883: 55) mentions and lists several specimens supposedly of "*Uta schottii* Baird"; but Cope (1900: 320) says, "I have been unable to find the typical specimen of this species, and the above description [given immediately prior to this passage] is taken from Professor Baird's manuscript. No other specimens have been correctly

[2] The young of this species possibly are spotted, but since they are not yet known, no comparisons with the young of *chlorosoma* and *triaspis* can be made at present.

[1] Contribution No. 20, from the Department of Zoology, Ohio University, Athens, Ohio.

identified with it, those given in Yarrow's check list being the *U. stansburiana.*" It was perhaps somewhat the same reasoning that caused Boulenger (1885: 211) to include *schottii,* with a question, in his synonomy for *Uta elegans.* Van Denburgh (1922: 203, 216, 241) included *schottii* in the synonomies of *symmetrica, nigricauda,* and *elegans,* and since that time, the matter seems to have rested. The fact remains, however, that none of these references is correct; far from being a synonym of any of the species mentioned, *Uta schottii* is distinct and valid, and must replace another name of nearly as long standing.

The original description of *Uta schottii* is quite brief; I quote it in full:

> *Uta schottii,* Baird.—Dorsal scales and size as in the last. Head pointed, narrow, nearly or quite as high as wide. General color nearly black, scarcely lighter beneath. Back with small blue spots. Tail banded laterally with the same.
> *Hab.*—Sta. Madelina, Cal. Mex. Boundary Survey.
> A. Schott. Type No. 2761.

Certain important facts may be gleaned from this succinct description. In the first place, the species in question is definitely not related to any of the *stansburiana* group (which includes *elegans*), but must instead be placed within the *ornata* group (*symmetrica, lateralis,* et al), for Baird distinctly states "Dorsal scales. . . . . as in the last." The "last" refers to the description of *Uta symmetrica,* which immediately precedes that of *schottii* on the same page. Further, Cope (*loc. cit.*), in quoting a description of *Uta schottii* taken from Baird's manuscript, says, "The dorsal large scales are in two very regular series on either side of the median line (making four), and inclose an interval filled with two or three rows of much smaller, though irregular carinated scales. The large scales appear much larger than in allied species." These quotations quite definitely place *schottii* in the *ornata* complex, which is characterized by one or more series of enlarged dorsal scales on either side of a smaller, irregular, vertebral series.

The origin of the type specimen is important in the proper allocation of the species in question. Although in the original description Baird says "Sta. Madelina, Cal.," Dr. Stejneger informs me that the allusion to California was omitted in the original entry for the type in the catalogue of the National Museum. In the year following the original description of *schottii,* Baird again makes mention of his species (1859: 7), and repeats the description verbatim, save that the "Cal." of the original description is omitted. The number of the type, stated as 3761 rather than 2761 in Baird's paper, is due to a typographical error, according to Dr. Stejneger. The "Sta. Madelina" of the original description does not exist in California; there is, however, a town by the name of "Magdalena" in Sonora, Mexico. It is from this latter locality that the type of *Uta schottii* originated. I am further indebted to Dr. Stejneger for the information that Schott, after surveying the boundary between Nogales and the mouth of the Colorado River with Lieut. N. Michler's party, left for home with them, from Sonoyta, Sonora, on August 25, 1855, and proceeded eastward via Magdalena, Sonora, Janos and El Paso. A specimen of *Diadophis regalis* was also taken at Magdalena by Schott, and is still on the shelves of the National Museum, in fairly good condition. The

original reference of the locality to California by Baird can only be ascribed to an oversight. It may be added that the type of *Uta schottii* no longer exists, for the original entry in the National Museum catalogue is marked in Cope's handwriting (prior to 1889) "destroyed."

In a recent paper (1941: 68) I have pointed out that there is no real difference between insular and mainland specimens of *Uta ornata lateralis* Boulenger (1883: 342). I have shown further that *lateralis* extensively intergrades with the subspecies of southern Arizona (*U. o. linearis*) in a belt bordered on the north by the line Reforma-Cananea, and on the south by the line Caborca-Magdalena. Typical specimens of *lateralis* are usually found somewhat south of Magdalena, but occasional specimens from this locality are in no way different than those from more southerly points, and melanistic specimens of *lateralis* are quite common throughout Sonora. The type locality of *Uta schottii* being within the range of the species hithertofore referred to as *Uta ornata lateralis* Boulenger, it must be concluded that *U. schottii* has precedence over *U. o. lateralis*, and the latter must be regarded as a synonym. With the addition of *Uta gularis* Cragin, type locality Guaymas, Sonora, I arrive at the following synonomy:

Uta ornata schottii Baird

Uta schottii Baird, Proc. Acad. Nat. Sci. Philad., 10, 1858: 253.
Uta gularis Cragin, Bull. Washburn Lab. Nat. Hist., 1, 1884: 7.
Uta (*Phymatolepis*) *lateralis* Boulenger, Ann. Mag. Nat. Hist., (5) 11, 1883: 342.
Uta lateralis Boulenger, Cat. Lizards Brit. Mus., 2, 1885: 214.
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A New Plethodont Salamander from Oklahoma [1]

By George A. Moore and R. Chester Hughes

THE discovery of the new species of *Eurycea* described below is attributed to Mr. Aaron Seamster of Connors State Agricultural College, Warner, Oklahoma, to whom the writers are gratefully indebted for their first lot of specimens. Altogether 21 adults and 66 larvae were obtained. They were collected on April 20 and May 3, 1940, and March 29 and April 11, 1941, all from Swimmer's Creek within less than a mile of its entrance into the Illinois River and about 10 miles northeast of Gore, Oklahoma. Here the stream flows through rough, rocky, timbered land, its bed being composed mainly of rather large rocks with very little sand and fine gravel. The animals were found beneath stones in pools of comparatively still water and were caught by hand or with the aid of a small improvised muslin net. No other species of salamander was found in the immediate vicinity of the creek although Mr. Seamster procured *Plethodon glutinosus* at Jack's Bluff about one-half mile away on the river.

The name *Eurycea griseogaster* is proposed for the new form, the following description being based upon 85 of the above-mentioned specimens (19 adults and 66 larvae).

Eurycea griseogaster, n. sp.

(Figs. 1 and 2)

Type.—Field Museum of Natural History No. 37832, adult female, collected in Swimmer's Creek, near its junction with the Illinois River, 10 miles northeast of Gore, Sequoyah Co., Oklahoma.

Description of Adults.—With characteristics of the genus as defined by Dunn (1926). Measurements in millimeters taken from 21 specimens, 3 of which had had the tail damaged or regenerated and were not used in the measurements of tail and total length. Total length 48–81, average 69.7. Length of body from tip of snout to posterior end of anus 28–42, average 37.5. Length of tail 20–39, average 31.6. Head length from uppermost angles of gular fold to tip of snout 6.8–8.8, average 7.9, width just behind eyes 3.9–5.5, average, 4.8. Dimensional ratios, average: length of tail in total 2.2, length of head in total 8.8, length of head in body 4.7, greatest head width in head length 1.6.

Head depressed, widest shortly behind eyes. Snout rather sharply tapering, squarish at tip. Nasolabial grooves conspicuous. Trunk subcylindric. Tail moderately compressed along its entire length, the caudal fin persistent near the tip ventrally and along most of its length dorsally. Limbs delicate. Digits 4–5 (in one specimen 4–4 on right, 4–5 on left), free; in order of length—fingers 3, 2, 4, 1, and toes 3, 4, 2, 5, 1. Phalangeal formulae—fingers 1, 2, 3, 2 and toes 1, 2, 3, 3, 2. Costal grooves 20 pairs, with 7 to 9 between adpressed toes. Lateral line organs in 2 pairs of rows along sides of body with 1 or 2 corpuscles in each row on each metamere.

[1] Contribution No. 87 from the Zoological Laboratory, Oklahoma Agricultural and Mechanical College.

General color gray, blackish above, lighter below. Ground color whitish, the whole body being covered with melanophores which are most abundant dorsolaterally in a pair of ill-defined black bands that extend from middle of head to level of anus. Dorsum lighter than sides and frequently blotched by aggregations of melanophores. Pigment cells somewhat concentrated in the costal grooves. Dorsal fin of tail flanked by a pair of narrow submedian dorsal black lines which converge in front of the fin into a faint median stripe traceable for a variable distance anteriorly. The median dorsal light area of the trunk is thus divided posteriorly into two bands which curve downward at the level of the anus, become wider, and continue backward along the sides of the tail. Under parts rather evenly sprinkled with melanophores which tend to be slightly more abundant on the chin, throat, and chest. Living specimens blotched with silvery patches particularly noticeable about the lateral-line organs; these areas cream-colored in preserved animals.

Vomerine teeth, 9–11 on either side, arranged mostly in single file in paired, anteromedially convex, arcs that extend posteromesad from points just behind the respective choanae toward the parasphenoid teeth from which they are separated by a distance approximating the diameter of a choana. Parasphenoid teeth crowded in paired, narrowly elongate, lanceolate, anteriorly pointed and posteriorly rounded, patches separated by a space about equal to the greatest width of either; each patch, about 33 teeth long, 2 teeth wide anteriorly and 4 or 5 wide at widest level. Dentition of male not distinguishably different from that of female.

Sexes similar in general size, form, and coloration; distinguishable in the appearance of the cloacal lining which in the male is papillose and in the female strongly rugose longitudinally.

LARVAE.—Length 13–72 mm. Gills with long rami and numerous filaments. Tail provided with well-developed full-length dorsal fin widest posteriorly, and a ventral fin along the posterior third. Coloration differing from that of the adult in that the dorsum is more uniformly pigmented and the underparts are immaculate except for a sprinkling of melanophores on chest, chin, and sides of throat.

BEHAVIOR.—If a rock be lifted with sufficient care from over an animal it may remain motionless; disturbed, it scurries to cover beneath another stone.

HABITAT.—Beneath stones in still or slowly running water. According to residents in the vicinity of Swimmer's Creek, the stream ceases to flow during the summer.

PARATYPES.—Eighty-four specimens distributed in the zoological collections of the U. S. National Museum, the Carnegie Institute, the Field Museum of Natural History (Nos. 37833–39, 37843), the University of Michigan Museum of Zoology (Nos. 89427–35), the University of Oklahoma, the Oklahoma Agricultural and Mechanical College, and the University of Rochester.

DISCUSSION

Including the forms listed by Stejneger and Barbour (1939) and Moore and Hughes (1939), 12 species and subspecies are now recognized in the genus *Eurycea* Rafinesque, 1822, namely, *bislineata bislineata* (Green),

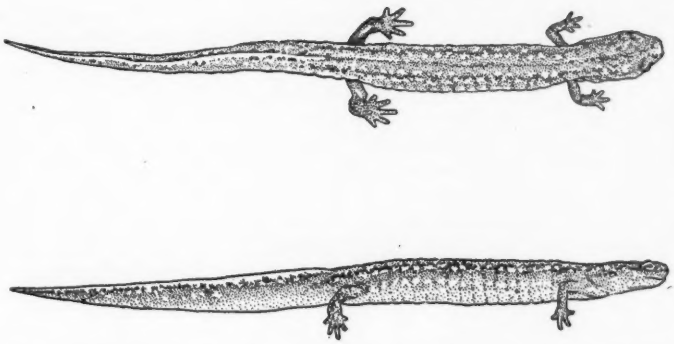

FIG. 1. Back and side view of paratype of *Eurycea griseogaster*. Drawing by Marian L. Stalker, furnished through courtesy of Dr. Sherman C. Bishop.

Fig. 2. Type locality of *Eurycea griseogaster*. A view of Swimmer's Creek shortly above its entrance into the Illinois River about 10 miles northeast of Gore, Sequoyah County, Oklahoma. Photograph taken April 11, 1941.

1818, *b. cirrigera* (Green), 1839, *b. major* Trapido and Clausen, 1938, *b. wilderae* Dunn, 1920, *longicauda longicauda* (Green), 1818, *l. guttolineata* (Holbrook), 1838, *lucifuga* Rafinesque, 1822, *melanopleura* (Cope), 1893, *multiplicata* (Cope), 1869, *neotenes* Bishop and Wright, 1937, *tynerensis* Moore and Hughes, 1939, and *griseogaster,* n. sp., may be recognized now.

The new species was studied in comparison with descriptions of all of the previously known forms of *Eurycea,* the accounts of Dunn (1926) having been used for the older species and the original descriptions for the newer ones. In general appearance and proportions and the large number of costal grooves (20 pairs) *E. griseogaster* resembles two other forms of eastern Oklahoma, *E. multiplicata* and *E. tynerensis,* and differs from all the others. For purposes of comparison we had at our disposal several cotypes of *E. tynerensis* and an abundant supply of *E. multiplicata.* Our specimens of the latter form were collected by Mr. Willis W. Collins in McCurtain County, Oklahoma, not far from the type locality of the species and some of them were kindly identified for us as *E. multiplicata* by Mr. M. Graham Netting of Carnegie Museum.

The new species differs from *E. tynerensis* in being considerably larger—even in the larval stage, in not being neotenic, in having much fewer lateral line organs which are more definitely arranged in longitudinal rows, and in the general pigmentation of the ventral surface.

E. griseogaster differs from *E. multiplicata* in having a darker general coloration, including a universal distribution of melanophores on the ventral surface, a relatively much shorter tail, a greater number of vomerine teeth, and in the absence of yellow on the under side of the tail and posterior part of the abdomen.

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Two New Ambystomid Salamanders from Chihuahua

By Edward H. Taylor

Among the novelties obtained by Mr. Irving Knobloch at Mojárachic, Chihuahua, Mexico, are two species of salamanders which were collected from a small mountain stream at an elevation of about 6,000 feet. Collections were made at two different times. In 1939 he obtained the types of *Ambystoma rosaceum*, and in the spring of 1940 he obtained a second species from the same stream, here described as *Ambystoma fluvinatum*. The type of the later species has lost the dorsal fin, but the gills show no signs of disappearing. Mr. Knobloch was unable to learn of any salamander living on land in the region where they were collected. It is possible that neither species makes a complete transformation.

Ambystoma ***rosaceum,*** sp. nov.

Type.—EHT-HMS No. 23054; Mojárachic, Chihuahua, Mexico; Irving Knobloch, collector. Female larva.

Paratypes.—EHT-HMS Nos. 23055-23058, larvae. Topotypes.

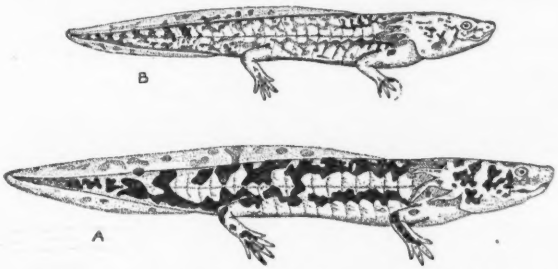

Fig. 1. A. *Ambystoma rosaceum*, sp. nov. Type, natural size. B. Same. Paratype; EHT-HMS. No. 23055, natural size.

Diagnosis.—Larva at 85 mm. reddish or pinkish with dense black marks or reticulations, immaculate pinkish below; gills well-developed with about 20 gill rakers on each middle arch; pterygoid teeth 10–10; vomerine teeth about 30–30; maxillary-premaxillary teeth about 30–30; splenial teeth about 50; web involving only metatarsals and metacarpals.

Description of Type.—Head rather flattened, broad, somewhat truncate, its width contained in body length about 4 times; distance between nostrils 4.8 mm., narrowest interorbital distance 4.2 mm.; diameter of eye 2.6 mm., distance between eye and nostril 4 mm.; the lateral line organs discernible on side of head; these on the dorsal region and on side of body obsolete; a dorsal fin arising on the back, 23 mm. from tip of snout, slightly behind a line connecting axillae; elevation of fin at level of hind limb 2.8 mm.; its greatest width at base of tail, 3.1 mm.; ventral caudal fin only a little narrower than dorsal.

Limbs well developed, the toes reaching the elbow of the adpressed limbs; phalangeal formula for fingers, 2, 2, 3, 2; for toes, 2, 2, 3, 4, 2; toes flattened

and pointed, the web extending to, or barely extending beyond, ends of metatarsals and metacarpals; two metatarsal and two metacarpal tubercles; 11 distinct costal folds, 12 if an indistinct one in groin is counted. Maxillary-premaxillary teeth in a single row; vomerine teeth in somewhat curved patches, separated medially by a distance equal to one-third of their length, with about 30 teeth in each, arranged in short diagonal lines of three teeth; these patches narrowly separated from small patches of pterygoid teeth; splenial teeth (coronoid, of certain authors) in a narrow elongate series, irregularly placed in more than a single row; floor of mouth, when elevated, with a free, sharp-edged cartilaginous extension forming a "tongue." The choanae half covered by a semi-transparent cartilage with a straight outer edge.

Color.—The specimen examined shortly after preservation showed the ground color pinkish to reddish, with intense black spots or reticulations; on the head the spots are scattered, but on back they tend to form a dorsolateral and a lateral row, leaving the region of the lateral line and the entire ventral surface immaculate; fin semi-transparent, the spotting less intense than on body; limbs spotted with black.

Measurements of Type in mm.—Snout to anterior end of vent, 48.5; tail, 36.5; total length, 85; head width, 12; length of snout, 5.7; snout to arm insertion, 19; snout to gular fold, 14; axilla to groin, 21.8; arm length, 17.2; leg, 17.

Remarks.—The paratypes are in a poor state, having been dead some time before being preserved. These are all younger than the type. The specimens were obtained from a small stream. Whether the species transforms completely cannot be stated at the present time.

Ambystoma ***fluvinatum,*** sp. nov.

Type.—EHT-HMS No. 25383. Mojárachic, Chihuahua, Mexico; Irving Knobloch, collector; June 20, 1940.

Paratypes.—EHT-HMS Nos. 25384–25395 larvae. Topotypes.

Diagnosis.—A small (perhaps neotenic) species, the larvae of 80 mm. with a ground color of greenish yellow, with brownish or blackish markings; belly yellowish, with very slight scattered pigmentation; gills well-developed; adpressed leg reaching half-way to elbow on adpressed arm; no dorsal body fin; tail fin beginning somewhat behind base of tail; subcaudal fin nearly obsolete; vomerine and pterygoid teeth in a continuous arched series separated medially, 20–21 teeth in all; splenial teeth wanting at this age; web deeply incised between metacarpals and metatarsals.

Description of Type.—Head moderately flattened; the snout oval, not truncate; width of head contained in body length 4.2 times; distance between nostrils about equal to the interorbital width; eye length 2.05 mm., distance of eye to nostril 2.6 mm. The lateral line organs distinct on head and body, appearing as small pits, the rims of which are black; a row beginning above nostril, extending back above the eye, bending down behind eye, and running forward below eye to nostril; traces of three rows of pits evident on sides, usually as minute black dots in the center of cream spots; those of the median lateral row most conspicuous; a dorsal fin on tail beginning posterior to the base and extending to underside, where it can be

traced only as a slight ridge; the greatest height of the caudal fin nearly as great as the depth of the tail at the same point. Limbs well-developed, the adpressed leg reaching half-way to elbow of adpressed arm; digits strongly flattened, pointed; the metatarsals and metacarpals free for nearly half their length; phalangeal formula, 2, 2, 3, 2; 2, 2, 3, 4, 2; two metatarsal and two metacarpal tubercles; skin of throat and chin in folds radiating from the nuchal fold; 11 distinct costal grooves, and an indistinct inguinal groove.

Maxillary-premaxillary teeth, apparently in a single row, 28–30. Choanae large with a hook-like projection from cartilage on inner edge; vomeropterygoid teeth continuous, the two series forming an arch much anterior to the level of the choanae, and separated medially; about 32–32 mandibular teeth in a single row; splenial teeth absent; floor of mouth, when elevated, has a short, blunt free edge; a thickened pad just inside the lower jaw.

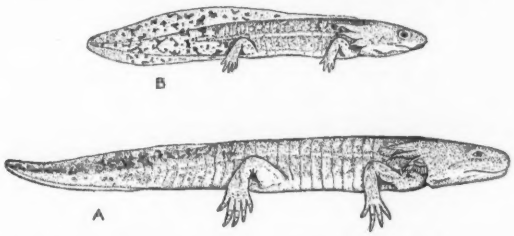

FIG. 2. A. *Ambystoma fluvinatum*, sp. nov. Type, natural size. B. Same. Paratype; EHT-HMS No. 25387, natural size.

COLOR.—Grayish to olive on a greenish-yellow ground color above, with a few lighter flecks or spots; immaculate yellowish-flesh color below; dorsal part of head nearly uniform, lighter on sides and on lips; back mottled olive to gray-brown; a more or less continuous faint irregular lighter line begins above arm and extends along side of body and tail; below this, body colored as on the back; arms and legs faintly marked above; a series of darker spots along the base of the caudal fin.

MEASUREMENTS OF TYPE IN MM.—Snout to anterior end of vent, 42; length of snout, 4; snout to arm, 16.2; snout to gular fold, 12; tail, 38; axilla to groin, 19; arm, 13.4; leg, 15.1; total length, 80.

REMARKS.—The larval paratypes form a series from a length of 35 mm. (snout to vent 20 mm.) to 65 mm. (snout to vent 32.5 mm.). These are very uniform in coloration. There is a dorsolateral light line formed by the light spots associated with the upper lateral-line pores; a lateral line follows the lateral-line pores; the ventrolateral series of pores are below the lateral pigmentation. All these are very minute and are scarcely discernible, save on head where they are larger.

In the 65 mm. specimen the foot reaches to wrist when limbs are adpressed; the dorsal fin begins on a level with the second costal fold and continues around the tip of tail to anus. The ventral part is somewhat narrower than the dorsal part.

There is a series of about 27 splenial teeth; the pterygoid and vomerine teeth are in separate patches, each shorter than in the type, but containing many more teeth; the maxillary-premaxillary row is single, as is the mandibular. There is a suggestion of a fold on anterior edge of forearm, and from elbow to fourth finger on posterior edge of forearm.

The relationships of these forms is obscure. Certainly they do not belong in the *tigrinum* group. Neither do they appear to be related to *Ambystoma schmidti* nor *A. texanum* since they have only a single row of maxillary teeth.

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A Redescription of *Lampropeltis triangulum temporalis* (Cope)

By Robert H. McCauley, Jr.

During a collecting trip to the eastern shore of Maryland in the spring of 1938, two unusual specimens of *Lampropeltis* were found in the collections of two schools, the Berlin High School and the Snow Hill High School, both in Worcester County. The first was plowed up from a field near Berlin. The second was found in Snow Hill in the cellar of a residence between the stones of the foundation. These specimens are notable because their markings and coloration are similar to those of *L. elapsoides virginiana* while their squamation is that of *L. t. triangulum*. The third specimen, now No. Z38.3 in the Newark Museum, was collected near Greenbank, Burlington County, New Jersey. It was found dead on a secondary road after heavy rains, July 25, 1938, by Miss Dorothy Thomas and Mr. Hollis Koster. Two additional specimens in the collection of the Zoological Society of Philadelphia from Mount Misery, in the same county, were made available to me by Mr. Roger Conant. They likewise show the above mentioned characters to some degree.

At least six more specimens like these have been examined. Four are from the District of Columbia; No. 52203 in the Museum of Zoology of the Uni-

versity of Michigan (UMMZ), No. 3598 in the collection of the Philadelphia Academy of Natural Sciences (ANSP), and Nos. 8368 and 17292 in the United States National Museum (USNM). A fifth (ANSP No. 3601) is of doubtful origin but may be from Delaware. The sixth (ANSP No. 3597) from Delaware is the type of *Ophibolus doliatus temporalis* described by Cope in 1893.

No form of *Lampropeltis* is recognized at present to which these specimens can be referred. The only available name is *L. t. temporalis,* which I redescribe below.

I am indebted to Professor A. H. Wright of Cornell University for encouragement and helpful suggestions, and to Dr. W. T. M. Forbes and Mr. Harold Trapido for further suggestions and criticisms. For the loan of material I am grateful to Dr. Leonhard Stejneger and Dr. Doris Cochran of the United States National Museum, Dr. E. R. Dunn of Haverford College, Mrs. Helen T. Gaige of the University of Michigan Museum of Zoology, Miss Beatrice Winser of the Newark Museum, and Mr. Roger Conant of the Philadelphia Zoological Society. I obtained the Berlin and Snow Hill specimens for the United States National Museum through the generosity of Mrs. William Farlow, biology teacher, and Mr. H. B. Scarborough, Principal of the Berlin High School, and Mr. Wilbur Jones, biology teacher, and Mr. O. P. Simmons, Principal of the Snow Hill High School.

Lampropeltis triangulum temporalis (Cope)

TYPE.—No. 3597, Academy of Natural Sciences of Philadelphia; Delaware.

DIAGNOSIS.—Similar in form and squamation to *Lampropeltis t. triangulum* but differs in the following characters: (1) dorsal pattern consists of bands or half-rings which extend to or upon the ends of the gastrosteges, rather than of spots or blotches; (2) number of dorsal saddles fewer in number; (3) alternating series of spots absent from sides, present only upon gastrosteges; (4) belly pattern follows a consistent plan, not checkered or irregularly mottled as in *L. t. triangulum;* (5) head markings obscure or absent; (6) number of gastrosteges lower than in *L. t. triangulum;* (7) a black-bordered light half-collar is consistently present or indicated.

Resembles *L. elapsoides virginiana* in pattern, but differs as follows: rostral not pointed as in *L. e. virginiana;* size larger and form more robust; greater number of dorsal saddles; black bands do not suddenly widen dorsally, and are not appreciably wider dorsally than the white bands; the number of gastrosteges tends to be greater.

DESCRIPTION OF TYPE SPECIMEN.—"Saddle spots closed laterally on gastrosteges; alternate spots entirely on gastrosteges. A half collar behind parietal plates, no superciliary stripe. . . . The collar of ground color is complete in its anterior border as well as the posterior in the form *temporalis,* owing to the disappearance of the chevron. The transverse band on the prefrontals has also disappeared . . . the intermediate spots are exclusively gastrostegal. The spots which alternate with them have fused on the middle line." (Original description, Cope, 1893: 1068-1069, pl. 25, fig. 4.)

Dr. E. R. Dunn kindly examined the type specimen and reports (*in litt.*)

as follows: sex, male; 27 saddles, of which 6 are on the tail; ventrals 188; caudals 42; scale rows 19-17; oculars 1-2; temporals 1+3 on right, damaged on left (probably 2+2); supralabials 7; infralabials 9 right, 8 left; loreal low and long; total length 492 mm., tail 68; "the red of the saddles occasionally anteriorly gets on to tips of ventrals."

Obviously this is a snake very different from the typically blotched *L. t. triangulum*. However, in markings at least, it is one of the least extreme specimens of the lot, and may be considered actually the least typical specimen of *L. t. temporalis* as here defined. A composite description, based upon the eleven specimens mentioned, follows.

General Description.—Scale rows at middle of body, 21 in six, 20 in one, 19 in four; ventrals 173–197 (average 192); caudals 36–49 (average 45); supralabials 7; infralabials 8, 8–9, 9; oculars 1–2; temporals 1+2+3 to 2+3+4; loreal present, longer than high; total length 197–788 mm. (six specimens more than 490 mm.); tail/total length .129–.152 (average .136). Coloration: head pattern greatly reduced or absent; a light half-collar bordered by black present behind head, anterior border at least touching parietals; dorsal pattern of body and tail, 24–37 (average 32) half-rings of red enclosed by black edges, and separated by bands of nearly white ground color; red areas of these half-rings touch or encroach widely upon the gastrosteges; black rings not conspicuously wide dorsally (1/3 scale lengths) or wider than the white rings (1½–2½ scale lengths); white rings conspicuously wider ventro-laterally or not; alternate blotches entirely or almost entirely upon the gastrosteges, no lateral alternating series; black fleckings on the scales present at least upon the sides of the white areas; belly white, marked only by ventral black edges of red bands, and black blotches opposite ends of white bands.

Variation.—One specimen (UMMZ No. 52203) has a maximum of only 19 scale rows and a minimum at the anus of only 15. The ventrals number only 173. In this generally reduced body scutellation, it closely resembles *L. elapsoides*. In every other respect, however, it conforms to the description of *L. t. temporalis*. It seems apparent that an abnormal reduction in body scales has occurred. That such reduction is possible, perhaps as a result of some abnormal treatment of the embryo, is indicated by Klauber (1936).

The infralabials in at least six of the eleven specimens are 9 on one side and 8 on the other; in one they are 8:8; in one the condition of the specimen renders the number doubtful (it may be 9:9); and in two they are 9:9. Five specimens have the temporals reduced on one or both sides.

Variations in pattern result mainly from differences in the amount of black pigment present. The smaller Washington specimen (ANSP No. 3598) has the saddles with very wide black edges and much dark pigment upon the head. The Berlin specimen (No. S 358 in my collection), in addition to wide black bands on the dorsum, has the black areas of the venter so accentuated that on the posterior two-thirds the white is limited to a series of elongate streaks between the ends of the saddles. It is closely resembled in this respect by the specimen (ANSP No. 3601) supposedly from Delaware. Another variation occurs in the degree of mottling and flecking which appears upon

the scales. The Washington specimen (UMMZ No. 52203) is nearly immaculate in this respect, having mottlings only on the sides of the white areas.

DISTRIBUTION.—Coastal Plain New Jersey and Chesapeake Bay region. Southern limit not known.

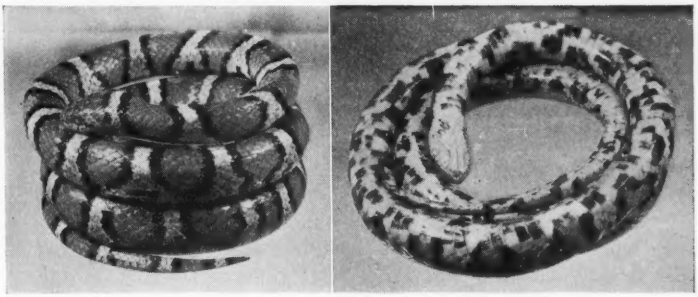

Figure 1. *Lampropeltis triangulum temporalis* (Cope), Mount Misery, Burlington County, New Jersey. Specimen in collection of Zoological Society of Philadelphia.

REMARKS.—*Lampropeltis triangulum temporalis* is most closely allied to *L. t. triangulum* and is apparently a form characteristic of southern New Jersey and the Chesapeake Bay region. Intermediate specimens from the District of Columbia (USNM Nos. 6247 and 67362), West Lakewood, N. J. (CU No. 1281), southern New Jersey (Zoological Society of Philadelphia), and Woodstock College, Md. (St. Joseph's H. S., Philadelphia), tending very strongly toward the *L. t. temporalis* condition have been examined by the writer.

Numerous other intermediate specimens are known which show less strong tendencies toward *L. t. temporalis*. In short, every conceivable degree of intergradation exists between the typical form and this subspecies. It is difficult to know where to draw the line of division. As stated above, the type of *L. t. temporalis* is the least extreme specimen of the series here placed in *temporalis*. Individuals tending more strongly toward *L. t. triangulum* are considered either to be intermediate or to belong clearly to the typical subspecies.

Blanchard (1921: 192, 198–202) makes frequent mention of the tendencies of *L. t. triangulum* toward a reduction in numbers of scale rows, gastrosteges, temporals, dorsal saddles, and head markings in the region of New Jersey, Delaware, and eastern Maryland. These tendencies reach their extreme in *L. t. temporalis*, although the variations in temporals and infralabials seem to indicate that this form has not reached a static condition. The theory that it may have evolved or be evolving from *L. t. triangulum* is also indicated by the relatively recent geological age of the area it occupies.

The ecological distinction between the ranges of *L. t. triangulum* and *L. t. temporalis* appears to be important. As has been shown by McAtee (1918: 57–74) and others, the fall line, north of the Potomac at least,

serves as a barrier between the flora and fauna of the Coastal Plain and the Piedmont Plateau. Neither *L. t. temporalis* nor specimens closely approaching it have been found much west of the fall line. The scarcity of specimens indicates that *L. t. temporalis* tends to be a burrower. As such it may reasonably be expected to prefer the softer, sandier, less rocky soils of the Coastal Plain to those of the Piedmont. *L. t. triangulum*, on the other hand, is well known to be a versatile subspecies, relatively unspecialized in habits. It is therefore not surprising that intermediates and occasional specimens of typical *L. t. triangulum* are found on the edges of or even somewhat within the range of the latter. It must be remembered that the total width of the Coastal Plain in the Washington area is much less than the area of overlap and intergradation shown, for instance, by Blanchard for *L. t. syspila* and *L. t. triangulum* (1921: 182, 195).

The area from southern New Jersey through Delaware, Maryland, the District of Columbia, and eastern Virginia may comprise a faunal area with distinctive ecological conditions with a number of animals more or less peculiar to it, as set forth by McAtee (1918) who points out that areas in Coastal Plain Maryland similar to the New Jersey pine barrens may have as many as 70 per cent of the characteristic pine barren species of plants.

The relation of *L. t. temporalis* to *L. e. elapsoides* and *L. e. virginiana* is not clear. The possibility that a northern form exists (i.e., *temporalis*) intermediate between *L. e. elapsoides* and *L. t. triangulum* is indicated by a single specimen from Alberene, Albemarle County, Virginia (USNM No. 25321) referred by Blanchard to *L. e. virginiana*. It resembles *L. e. virginiana* closely in shape, but the markings are more like those of *L. t. temporalis*, while the squamation is somewhat intermediate. On the other hand, Blanchard records typical *L. t. triangulum* from Florida and South Carolina which apparently do not show strong tendencies toward a ringed pattern as do those from the Chesapeake region. These considerations, however, are not within the scope of the present paper.

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Salientia of Northern Pontiac County, Quebec

By Ronald Grant

THE material upon which this note is based was collected in northern Pontiac County, Quebec, during July, 1940, from an area within a radius of about 35 miles from Wolf Lake, Long. 47° 40′ N., Lat. 77° W. Since early-breeding forms had already left the ponds and had ceased to call, the list is incomplete, but no other herpetological records seem to be available for this region.

The area lies immediately south of the height of land between the Ottawa River drainage system to the south and the James Bay drainage system to the north. It is on a plateau, the average height of which is about 1300 feet, and there are a few hills rising more than 300 feet above the level of the lakes. Geologically it is typical Laurentian Shield territory, with sand and boulder-clay deposits in most low-lying places. Climax forest covers most of the land. There are many lakes, most of which drain into the Ottawa and Gens-de-Terre rivers. Water surface temperatures in lakes and ponds were 19° to 24° C., and the pH 6.1 to 6.8. In a few streams fed by springs or draining sphagnum bogs, temperatures down to 12° C. and pH readings down to 5.7 were recorded. The following species of frogs and toads were found.

Bufo americanus americanus (Holbrook).—Common throughout the area and very abundant locally; usually found on land, but a few taken from water. Most of the toads were brilliantly colored, with patches of pink below and many small pink-tipped warts on the sides. The dorsal spots were deep black, with several large warts in each. These toads thus tend to resemble *B. americanus copei* Yarrow and Henshaw in coloration, but lack the structural peculiarities of that subspecies. Logier (1928) has noted the more brilliant coloration of northern toads. The call was heard occasionally until July 17.

Rana clamitans Latreille.—Common in shallow water around all lakes. Most individuals were very dark in color and some had large black dorsal spots. Some immature animals were indistinguishable from *R. septentrionalis* in color. Logier remarks on similar dark coloration in *R. clamitans* from Lake Nipigon. These frogs seemed to be breeding throughout July but no egg masses were found. Croaking males were heard throughout the month, and three out of five mature females caught on July 22 had laid their eggs. Metamorphosing tadpoles were found on July 22. The smallest mature female taken was 72 mm. in body length; males appear to mature at about 54 mm.

Rana pipiens Schreber.—The most common frog; seldom found in water but abundant in open parts of the forest. Metamorphosis of tadpoles had not begun by July 22.

Kauffeld (1937) reaffirms the distinctness of Cope's *Rana virescens brachycephala*, adding several distinguishing characteristics to the original definition and raising *pipiens* (= *virescens*) and *brachycephala* to specific

rank, regarding *brachycephala* as replacing *pipiens* in New England and southern Canada. Stejneger and Barbour (1939) follow Kauffeld. The validity of Kauffeld's criteria for separating the two species has been questioned by Trapido and Clausen (1938).

The 24 mature leopard frogs from Wolf Lake (which are identical with those in the Montreal region) agree with Kauffeld's definition of *R. pipiens,* and differ from that of *brachycephala,* in having the head length entering total length of head and body less than 3½ times (2.8 to 3.4 times); several short dorsal skin folds in addition to the dorso-lateral folds; and web leaving free two phalanges of the fourth toe and one phalanx of each of the other toes. They resemble *brachycephala* in that there is no white tympanic spot; the dorso-lateral folds extend onto the supra-ocular region in 6 out of 24; the tibio-tarsal joint does not reach the snout in 16 out of 24. Leg length varies considerably, the tibio-tarsal joint reaching beyond the snout in 3. In leopard frogs, as in wood frogs, the legs are thought to be relatively shorter in animals from the north (Schmidt, 1938).

Rana septentrionalis Baird.—Common, especially in shallow and weedy water and always found in or near water. These frogs are variable in color and pattern but are distinguished from young *R. clamitans* by the less prominent dorso-lateral folds, smoother skin, more extensive webs and strong odor when handled. The smallest mature female captured was 48 mm. in length and the smallest mature male 46 mm. It seems probable, therefore, that *R. septentrionalis* females mature at the same age as the males, whereas *R. clamitans* females mature at a considerably larger size than the males and probably at least one year later. Some of the female mink frogs taken on July 20 to 22 had laid their eggs. *Rana clamitans* and *R. septentrionalis* thus occupy the same habitats and breed at the same time. Metamorphosing mink frog tadpoles were caught along with metamorphosing green frogs on July 22.

Rana sylvatica Le Conte.—Common both in the forest and at the water's edge. The 12 specimens collected are intermediate between typical *R. sylvatica sylvatica* and typical *R. sylvatica cantabrigensis* Baird, the heel reaching a point varying from the anterior border of the orbit to the tip of the snout. None show the mid-dorsal pale line commonly found in *cantabrigensis.* Wood frogs from the Montreal area are similar but have slightly longer legs. Authorities agree in separating the three subspecies of *Rana sylvatica* (*sylvatica, cantabrigensis, latiremis*) mainly on the ratio of leg length to body length. Data given by Patch (1939), Schmidt (1938), Boulenger (1920) and others indicate that when this criterion for separating *sylvatica* from *cantabrigensis* is taken (leg length to heel equal to, or greater than, body length in *sylvatica*), the territories occupied by the two subspecies are separated by the St. Lawrence River and the Great Lakes. But Preble (1902) and Schmidt (1938) have noted that there is a progressive decrease in the relative length of the legs in wood frogs with increasing latitude, so that it is possible that the differences between the three supposed subspecies of *R. sylvatica* may be due to the influence of environment upon the expression of similar genetic potentialities, *R. s. sylvatica* of the southeast merging into

cantabrigensis to the northwest and the latter into *latiremis* in the far north. Until further studies have been made it seems advisable to withold subspecific rank from these forms of the wood frog.

Rana catesbeiana was entirely absent from the region around Wolf Lake although it is common at St. Jovite, Lat. 46° N. *Rana palustris* was not found although it has been taken in the Laurentian Mountains (Lat. 46° N.). Cope (1889) assigned three specimens collected by Drexler from "James Bay N.B." to *palustris*. The identification was confirmed by Preble (1902). The locality designated has been assumed by later authors to be James Bay proper, and since there is no James Bay in New Brunswick this is probably the correct interpretation. Since there are no other records of this species from high latitudes, Cope's record should not be accepted without confirmation by further specimens.

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The Covariance Method of Comparing the Head-Lengths of Trout from Different Environments [1]

By C. McC. Mottley

Introduction

THE identification of species and subspecies of *Salmo* has been based on the differences in such meristic characters as the number of scale-rows and upon variations in body proportions, such as the length of the head. The writer has shown (Mottley, 1934) that the number of scale-rows may be modified by changing the temperature during the development of the embryo, but the stability of such characters as the body proportions under different environmental conditions apparently has not been investigated. As the writer suggested, in describing the body proportions of the Kootenay Lake population of rainbow trout, *Salmo gairdnerii kamloops,* which was originally classified by Jordan and Snyder (1908), a satisfactory method of comparing the body proportions of different populations of fish remained to be developed.

Davidson (1935), however, has shown that the length of the head and certain other characters in a single population of pink salmon, *Oncorhynchus gorbuscha,* changed significantly as the spawning season approached. His method of comparison, namely the use of ratios between the size of the part and the size of the fish, may be valid for a single population where successive samples were taken at random from a single group of fish. In comparing trout populations, on the other hand, where environmental conditions affect the size of the fish, the use of ratios does not lead to efficient comparisons and a suitable method is needed.

In 1929, while making the biometrical study of the rainbow trout of Kootenay Lake already mentioned, the writer obtained a series of trout from Wilson Lake near Nakusp, British Columbia. Wilson Lake had originally contained no fish and was stocked with rainbow trout from the Kootenay Lake population; 10,000 fry and 10,000 eyed eggs were planted in 1923 and 20,000 eyed eggs in 1926. The measurements of the body proportions of the fish obtained in 1929 afforded an opportunity, therefore, to find out if such a dimension as the head-length had changed significantly under the different environmental conditions. This problem confronts the ichthyologist in making any racial analysis.

The Problem Stated

The purpose of the present paper is twofold: first, it is planned to draw attention to the covariance method of comparing the body proportions of different populations of trout, using the head-length dimension as an example; and second, to show how the method may be used by testing for a significant difference between the head-length dimensions of the Kootenay and Wilson Lake populations.

The Possible Solution

If a suitable method is used, the only solution to the problem which can be stated exactly is the one afforded by the null hypothesis as developed by Fisher (1937). The solution may be stated thus: if a stock of trout is trans-

[1] This material was obtained under the auspices of the Fisheries Research Board of Canada.

ferred from one lake to another the head-length dimension of fish of comparable size will be found to be different but the difference will be no greater than is to be expected by chance.

If it should occur that the difference is greater than that expected on the basis of a chance fluctuation, i. e., if the null hypothesis is refuted, then it may be assumed that some factor is affecting the head-length dimension. This conclusion, then, may become the object of future investigations which lie beyond the scope of the present paper.

TABLE 1

Showing the head-length (HL) and standard length (SL) of 50 male trout from Kootenay Lake and 10 male trout from Wilson Lake. The measurements are stated to the nearest millimeter.

KOOTENAY LAKE			
HL	SL	HL	SL
76	342	169	675
44	194	46	200
51	240	151	609
50	240	42	183
123	502	40	169
136	569	38	162
82	362	33	137
80	348	82	364
64	300	54	264
166	616	61	256
160	667	75	344
87	367	58	260
136	559	42	203
72	335	61	282
72	304	68	312
62	286	42	176
59	281	44	184
51	249	43	183
43	192	45	198
42	186	43	183
130	526	42	185
150	610	39	169
174	660	36	154
105	438	38	165
130	534	35	155
WILSON LAKE			
121	459	61	243
103	412	70	277
95	368	52	215
76	298	51	217
72	299	49	208

THE DESIGN OF THE TEST

The test, therefore, hinges on the suitability of the method of comparison. The fundamental assumption in any comparison is that the data selected shall be equally representative of the situations from which they are drawn. This stipulation is one of the most difficult ones for fishery investigators to meet because of the methods of securing samples. In the present case both samples were taken by angling. If this method of capture introduces a significantly greater amount of bias into the series from one lake than it does in the series from the other, then the conclusions will be invalidated. At present there is no evident reason for believing that either sample is biased.

There are a number of methods of comparing body proportions and it

seems advisable to mention them. Comparison may be made between the two populations by selecting individuals from the two lakes of the same size, age, sex and degree of maturity. Such standardized conditions are not always possible, especially when the two populations have different rates of growth. Furthermore, critical tests of significance are difficult and the method is inefficient, because many of the individuals sampled cannot be used.

TABLE 2

Showing the head-length (HL) and standard length (SL) of 50 female trout from Kootenay Lake and 10 female trout from Wilson Lake. The measurements are stated to the nearest millimeter.

KOOTENAY LAKE			
HL	SL	HL	SL
114	473	41	180
128	544	65	297
70	323	61	296
55	262	64	300
70	328	52	256
62	297	45	189
66	311	134	602
74	363	72	322
51	249	50	220
62	289	68	306
123	534	72	348
165	655	75	354
144	607	56	270
47	248	52	256
46	198	48	218
68	312	73	343
50	232	52	226
44	190	44	189
129	582	42	178
156	632	40	193
64	293	41	175
66	302	40	162
54	254	42	184
57	253	32	148
43	186	33	133
WILSON LAKE			
70	312	57	254
64	292	52	225
70	297	45	198
55	242	44	196
58	248	46	184

The writer (1936) described a graphic method of comparing populations but it is not suitable for critical tests of significance. Ratios have been widely used but valid inferences from such comparisons can only be drawn when it has been shown that the two variables, head-length (Y) and the length of the fish (X) follow a linear relationship of the form $Y = bX$. Usually such relationships are of the form $Y = a + bX$, when Y and X are the logarithms of these variables, and a and b are constants which describe the Y-intercept and the slope of the line, respectively. The constant b is known as the regression coefficient and describes the rate of change in head-length for every unit change in the length of the fish. Fisher (1936) has fully developed the method of making comparisons by means of the regression equation and they are adequately presented by Snedecor (1940).

There is a further precaution which is mentioned by Buchanan-Wollaston

(1936) to the effect that the absolute variation in the length of a part, such as the head, will have a smaller variance when compared with the absolute variation of the length of the fish. Furthermore, the use of logarithms instead of the original data obviates the difficulties imposed when the mean and variance are correlated (Snedecor, 1940, Section 16.7) and permits comparisons to be made by the use of the analysis of covariance.

TABLE 3

Showing the test of significance of the difference between the mean head-lengths ($\bar{y}$) of male trout from Kootenay and Wilson lakes, adjusted for differences in mean standard length ($\bar{x}$). (Symbols follow Snedecor, 1940).

Lake	Degrees of Freedom	Sum x^2	Sum xy	Sum y^2
Kootenay	49	2.04777	2.17892	2.35846
Wilson	9	.13389	.14850	.16570
Combined	58	2.18166	2.32742	2.52416

Error of Estimate $= Sy^2 - \frac{(Sxy)^2}{Sx^2}$

Kootenay	48	.03999	
Wilson	8	.001	
Combined	57	.04124	Variance = .000724

Test of Significance

			Variance
Total	58	.04926	
Combined	57	.04124	.000724
Between adjusted means	1	.00802	.00802**

$$F = \frac{.00802}{.000724} = 11.08, n_1 = 1, n_2 = 57$$

TABLE 4

Showing the test of significance of the difference between the mean head-lengths ($\bar{y}$) of female trout from Kootenay and Wilson lakes, adjusted for differences in mean standard length ($\bar{x}$). (Symbols follow Snedecor, 1940).

Lake	Degrees of Freedom	Sum x^2	Sum xy	Sum y^2
Kootenay	49	1.46773	1.47605	1.51937
Wilson	9	.05840	.05333	.05057
Combined	58	1.52613	1.52938	1.56994

Error of Estimate $= Sy^2 - \frac{(Sxy)^2}{Sx^2}$

Kootenay	48	.03503	
Wilson	8	.00187	
Combined	57	.03730	Variance = .0006544

Test of Significance

			Variance
Total	58	.08772	
Combined	57	.03730	.0006544
Between adjusted means	1	.05042	.05042**

$$F = \frac{.05042}{.0006544} = 77.05, n_1 = 1, n_2 = 57$$

THE MATERIAL AND METHODS

The Kootenay Lake material was obtained by taking random samples of 50 males and 50 females from the data collected in 1929 as already reported

(1936). The Wilson Lake series was obtained by drawing random samples of 10 males and 10 females from the collection of 25 fish which was made in July, 1929.

The methods of measuring the fish and the description of the head-length and standard length are given in the report mentioned (Mottley, 1936).

The Data

The original data are presented in Tables 1 and 2.

Transformation of the Data.—The original data were first transformed into five-place logarithms. The logarithms were then used in reducing the data according to the standard methods of regression to supply the following means and equations: E_{HL} is the expected head-length based on the standard length, SL.

1. *Males:*
   a. Kootenay Lake: mean HL = 1.8193; mean SL = 2.4555
      $E_{HL} = 1.064\ SL - .794$
   b. Wilson Lake : mean HL = 1.8556; mean SL = 2.4608
      $E_{HL} = 1.109\ SL - .874$
   c. Both lakes (total): mean HL = 1.8254; mean SL = 2.4564
      $E_{HL} = 1.067\ SL - .796$
2. *Females:*
   a. Kootenay Lake: mean HL = 1.7938; mean SL = 2.4488
      $E_{HL} = 1.006\ SL - .669$
   b. Wilson Lake: mean HL = 1.7431; mean SL = 2.3821
      $E_{HL} = .913\ SL - .432$
   c. Both lakes (total): mean HL = 1.7854; mean SL = 2.4377
      $E_{HL} = 1.000\ SL - .651$

The Test of Significance

The calculation of the errors of estimate and the test of significance, patterned after Snedecor (1940), Section 12.6, are shown in Tables 3 and 4. Both the male and female rainbow trout from Wilson Lake have significantly longer heads for their size than is to be expected on the basis of the null hypothesis.

Warranted Assertion

Using the method of the analysis of covariance the conclusion seems warranted that the population of rainbow trout transferred from Kootenay Lake to Wilson Lake had developed significantly longer heads. The factors responsible for this condition lie beyond the scope of the present paper.

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Records of Fishes from the Quetico Provincial Park of Ontario, with Comments on the Growth of the Yellow Pike-Perch

By R. G. LINDEBORG

FROM June 15 through September 1, 1935, the author and R. V. Drexler of the University of Illinois made an extended canoe trip through the Quetico Provincial Park and adjoining regions of southwestern Ontario. During the trip a few specimens were preserved and notes were taken on others. The material is deposited in the University of Michigan Museum of Zoology.

The region is located in the eastern portion of the Rainy River district and the western part of the Thunder Bay region, all within the Hudson Bay drainage system. The trip started at Ely, Minnesota, and described a large figure-eight with the most northerly point at Savanne, Ontario. The following lakes were visited in turn; from Basswood to Agnes, then north to Kawnipi, northwest to Russell, and north to Sturgeon and Doré; thence northeast to Pickerel, French, Eva, Elbow, Crooked and Mercutio; up the north arm of Bedivere to Mille Lac, the most northerly lake visited. From Mille Lac we traveled south through Kashabowie, and southwest through Upper Shebandowan, Burchell and Snodgrass; then down the Wawiag River to Mack Lake. From Mack we continued southwest to Kawa Bay of Kawnipi and then retraced our course almost to Shelley, finally turning south

into Cairn, Sark, Keefer, Kahshahpiwi, to end the journey in Ranger Bay of Basswood. All of the lake names used are taken from the Quetico Sheet (No. 52B), of the National Topographic Series, of the Canadian Department of Interior.

I wish to thank Carl L. Hubbs for checking the identifications and for help in the preparation of the paper, and H. J. Deason for help in reading the pike-perch scales.

List of Species

1. *Acipenser fulvescens* Rafinesque.—The rangers at Sturgeon Lake had pictures of a rock sturgeon, about 4 feet in length, which had been caught in this lake.

2. *Leucichthys hoyi* (Gill).—A single yearling specimen of the Great Lakes bloater was found dead on the south shore of Lake Eva, on July 18. This is the first record of the species in lakes other than the Great Lakes and Lake Nipigon. The distinguishing characters are, (following the methods of Koelz, 1927): maxillary 2.7, with a slight knob on the symphysis of the lower jaw; scales about 75; gill-rakers 14 + 27 = 41; L/H 3.6; AV/V 1.3; length of 76 mm.

3. *Cristivomer namaycush namaycush* (Walbaum).— We fished for lake trout only on a few occasions. Three were taken from Lake Louisa, one from Sark, and three from Eva.

4. *Catostomus commersonnii commersonnii* (Lacépède).—Young common suckers were seined in Mack Lake.

5. *Moxostoma aureolum* (LeSueur).—A single northern redhorse was found dead on the shore at the north end of Sturgeon Lake.

6. *Pfrille neogaea* (Cope).—Fine-scaled dace were collected in a small unnamed tamarack-bog lake just north of the north end of McKenzie Bay of Kawnipi Lake.

7. *Chrosomus eos* Cope.—A beaver pond just southeast of the narrows in Mack Lake yielded specimens of the northern red-bellied dace.

8. *Notropis cornutus frontalis* (Agassiz).—The northern common shiner was one of the most common minnows of the area. Collecting records are: Cairn Lake; Kawnipi Lake; north end of McKenzie Bay of Kawnipi (on June 23 and 29, in breeding condition); Agnes Lake, (one male in breeding condition on June 23).

9. *Notropis volucellus volucellus* (Cope).—Northern mimic shiners were seined at the following localities: northeast arm of Agnes Lake; south end of Agnes (one ripe female on June 18); Mack Lake; and Russell Lake (two ripe females, July 5).

10. *Hyborhynchus notatus* (Rafinesque).—Blunt-nosed minnows were collected from the south end of Agnes Lake; northeast arm of Agnes (one ripe female, June 23); Mack Lake; and Russell Lake.

11. *Esox lucius* Linnaeus.—Northern pike are very common throughout the region, especially in the shallow, weedy bays.

12. *Perca flavescens* (Mitchill).—McKenzie Bay of Kawnipi; and Mack Lake.

13. *Stizostedion vitreum vitreum* (Mitchill).—The yellow pike-perch is

one of the most common fish of the region and was found in practically every river and lake.

14. *Percina caprodes semifasciata* (DeKay).—Northern log-perch were collected in McKenzie Bay of Kawnipi Lake.

15. *Boleosoma nigrum nigrum* (Rafinesque).—Western Johnny darters were seined in McKenzie Bay of Kawnipi Lake and in Russell Lake.

16. *Micropterus dolomieu dolomieu* Lacépède.—Northern small mouthed bass were caught only in Point Lake, just south of Kahshahpiwi Lake.

17. *Ambloplites rupestris* (Rafinesque).—An immature male rock bass was secured in the northeastern arm of Agnes Lake.

The Growth of *Stizostedion vitreum*

The age and growth of the yellow pike-perch in the Quetico Park region was determined by an examination of the scales. Scale samples were saved from all of the pike-perch caught; over half of the fish were caught in Mack Lake. The fish were weighed on a spring scale reading to ⅛ pound. Fork lengths were measured with a metal tape and converted to standard and total lengths by means of the conversion factors given by Deason (MS). The results are summarized in the accompanying table.[1]

Age	No.	Standard Length, mm.			Total Length, Inches			Weight, Lbs.		
		Min.	Max.	(Ave.)	Min.	Max.	(Ave.)	Min.	Max.	(Ave.)
III	6	273	329	(304)	12.4	15.0	(13.9)	⅝	—1	(⅞)
IV	17	329	387	(359)	15.0	17.7	(16.5)	1	—1¾	(1½)
V	6	329	387	(359)	15.0	17.7	(16.5)	1¼	—1¾	(1½)
VI	23	387	477	(406)	17.7	21.9	(18.6)	1¾	—3½	(2⅛)
VII	17	397	487	(441)	18.2	22.3	(20.2)	2	—3½	(2⅝)
VIII	14	443	534	(494)	20.3	24.5	(22.6)	2¾	—4¾	(3¾)
IX	4	487	568	(532)	22.3	26.0	(24.4)	3½	—5½	(4¾)

By comparison with the figures of Eddy and Carlander (1939), the growth in length appears to be slower than for fish caught in Minnesota waters, except for the first two age classes. This circumstance may be explained by the fact that only the larger fish of the early age groups were taken by hook and line. Fish caught in Wisconsin lakes and in Lake Erie (Deason, MS) have about the same growth rate as the fish in this study. Growth is indicated as being slower in Lakes Winnipeg, Nipigon, and Abitibi, in the order named.

For all age classes the Quetico fish were heavier than those caught in Lakes Abitibi and Nipigon, and also heavier than the Lake Erie fish, except for the last three age classes. Wisconsin fishes were slightly heavier for the six-year and older classes.

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[1] No calculations were made for the length attained at each year.

A Tagging Method for Small Fish [1]

By Arthur D. Hasler and William M. Faber

THOROTRAST, (Heyden Chemical Co., New York, N. Y.) which is an X-ray opaque, slightly radio-active suspension of colloidal thorium dioxide (ThO_2) in a carbohydrate base, long has been used both in clinical medicine and in experimental work, as a method of rendering visible to X-rays, the spleen, liver and bone marrow of small animals and man. It is largely phagocytozed by the reticulo-endothelial system, retained in the body practically quantitatively throughout the life of the animal, and is harmless in small doses (Anders and Leitner, 1932; Naegeli and Lausche, 1932; Higgins and Smith, 1938). These facts suggested to us its use in tagging fish which were too small to be marked with a metal tag or clipped fins.

Procedure

A group of small trout, 4–6 cm. long, and 2–3 grams in weight, was anaesthetized with ¼ percent urethane. Each fish was injected intraperitoneally with 0.2 cc. solution of thorotrast (concentrations varied from 0.5 mg. to 52 mg. per 0.2 cc.) immediately posterior to the pelvic fin. Control fish were injected with 0.8 percent saline solution. The fish injected with any one dose were kept in separate tanks through which passed spring water (Madison Fish Hatchery) or water pumped from Lake Mendota (University of Wisconsin Lake Laboratory). These fish were fed the regular hatchery diet except that the groups kept at the University Lake Laboratory received in addition the plankton brought in by the running water from the lake.

One or two weeks following injection, a few fish were removed and X-rayed. During roentgenography some fish were anaesthetized with urethane, and later returned to the tanks; others were killed, X-rayed, and the viscera were prepared for histological examination.

The technique of roentgenography involved the use of the ordinary clinical apparatus—50 MA, 68 KV (136 V) 0.2 seconds at 45 inches. The commercial Eastman "No-Screen" film in a paper holder was used, with the fish arranged in rows upon a strip of cellophane superimposed on the holder.

Results

Experiment 1.—Thorotrast was injected intraperitoneally into three groups of fish, 50 in each group. One group received 52 mg. (0.2) cc. per fish, another 26 mg. (0.1) cc. and the third 13 mg. in (0.05) cc. Table 1 shows the lethal effect of the thorotrast at these high doses. This procedure was duplicated in experiment 1b in the 52 mg. and 26 mg. doses. The initial experiment showed that the dose of 0.05 cc. (13 mg.) was too small a volume to inject with any degree of accuracy. This experiment verified the results obtained in experiment 1a. Figure 1 illustrates the thorium in a 52 mg. dose.

Experiment 2.—The dose levels of the previous experiment were reduced by injecting a consistent volume of 0.2 cc. but varying the concentration. These groups were injected with 5.2 mg. and 0.5 mg. per fish (Fig. 2). Through this experiment we hoped to show the limits of visibility of the

[1] In cooperation with the Wisconsin Conservation Department.

thorium in the roentgenograms, and yet come within the limit of safe dosage. As can be seen from the tabulated data (Table 1), 5.2 mg. is lethal to an extent that makes this dose impractical. The dose 0.5 mg. per fish, on the other hand, does not appear to be harmful. Both these doses are detectable by the roentgenogram. Since 0.5 mg. was not harmful, yet visible, it was decided to try a heavier dose that might not interfere with growth, and yet be visible in the X-rays.

TABLE 1

SUMMARY OF EXPERIMENTS WITH THOROTRAST AT DIFFERENT DOSE LEVELS

Duration of Experiment	Dose in mg. per fish	No. of fish	Deaths
Exp. 1a			
11/27–1/10/41	0.2 cc. 52 mg.	50	22
11/27–1/10/41	0.1 cc. 26 mg.	50	11
11/27–1/10/41	0.05 cc. 13 mg.	50	21
Exp. 1b			
1/14–21/41	0.1 cc. 26 mg.	25	16
1/14–21/41	0.2 cc. 52 mg.	25	14
1/14–21/41		25	2
1/20–29/41	0.2 cc. 1:100 0.5 mg.	15	0
Exp. 2			
2/21–3/25	0.2 cc. 1:10 5.2 mg.	32	15
2/21–3/25	———	20	5
2/21–3/25	1:100 0.5 mg.	15	0
2/21–3/25	1:10 5.2 mg.	25	9

Experiment 3.—One mg. per fish proved not only harmless over a 2½ month test period, but the injected fish increased in weight at the same rate as did the controls (Fig. 5) (see Table 1). The roentgenogram of this group (see Fig. 3) shows the thorium plainly. A larger dose might prove advisable since the maximum tolerated dose will constitute the optimum dose as far as visibility is concerned. Indeed, in mammalian experiments an intravenous dosage of great magnitude (0.52 gm. per kilo) may be given without any apparent harmful effects. We intend to continue experimentation on dosage but believe that our colleagues should be aware of the method in case it applies to certain experiments where it might prove effective.

The lethal effect of the thorotrast in fish is not understood. Histological

examination of the tissue shows the material to be concentrated in the reticulo-endothelial cells of the spleen, liver and kidneys, and also in the peritoneal lymphatics surrounding the pancreas which is diffuse in the trout. Doses of 16–52 mg. concentrate in all the organs mentioned. Doses of 0.5 to 5.2 mg. are concentrated chiefly in the spleen, but in the higher limits of this range it is also found in the anterior end of the kidney where there is an abundant supply of lymphoid tissue. The tissue around aggregates of thorium shows no pathological reaction, no exudation, proliferation, or inflammation, but it appears as if the vascular channels are blocked, consequently it is suggested that the material may be incompatible with life in large doses because of this "vascular blockade" which seems so evident in our sections.

TABLE 2

SUMMARY OF EXPERIMENTS WITH THOROTRAST AT DIFFERENT DOSE LEVELS (*Continued*)

Duration of Experiment	Dose in mg. per fish	No. of fish	Deaths	Wt. of fish in gms.		Location
				Start	End	
Exp. 3 3/25–6/2	1:50 1.0 mg.	22	0	3.7	8.0	Lake Lab.
3/25–6/2	———	14	2	6.2	8.4	Lake Lab.
3/25–6/2	0.2 1:50 1.0 mg.	34	7	2.7	3.7	Fish H.
3/25–6/2	———	32	5	2.8	3.9	Fish H.

A roentgenogram of the viscera of the fish showed the practicability of saving space on the X-ray film. Although the fish may be X-rayed under an anaesthetic, it might prove more efficient to sacrifice the fish in the field under practical experimentation, bring them to the laboratory and X-ray only the viscera.

Figure 4 illustrates the effect of dilution from growth of a dose of 1 mg. per fish where the fish increased 2 grams in weight over a 2½ month experimental period. The fish were easily detectable.

Precautions.—1. During injection, care must be taken to allow the needle to penetrate deeply enough to prevent back-pressure drainage. The fluid will run out of the wound if injection is not carefully performed.

2. It is essential to keep temperature conditions constant during handling.

3. Fish should not be anaesthetized too long before injection. They should be narcotized only to the point where they do not struggle during handling, and after injection should be allowed to recover in water containing no anaesthetic.

4. Fish should be fasted at least one day prior to handling.

5. We found a ⅜ inch, No. 26 needle to be most useful. 0.2 cc. is the most practical volume of fluid for injecting 2–3 gm. fish.

Costs.—Thorotrast—10 vials (12 cc. each)—$4.50. One 12 cc. vial of thorotrast would permit the injection of about 3000 2 gm. trout with a dose of 1 mg. (0.2 cc. of thorotrast diluted 1:50). Eastman 8x10 film costs ap-

Fig. 1

Fig. 2

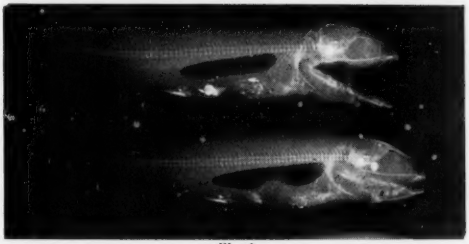

Fig. 3

Fig. 4

Fig. 5

Fig. 1. Roentgenogram shows extreme degree of opacity of liver, kidney and spleen when a 52 mg. dose of thorotrast is used.

Fig. 2. Visibility of thorium when a dose of 5 mg. is used.

Fig. 3. Visibility of thorium when a dose of 1 mg. per fish is used.

Fig. 4. Effect of dilution of 1 mg. per fish. 2½ months after injection. Size increase 2 gm.

Fig. 5. Uninjected fish.

proximately $2.50 per dozen. One 8x10 film would be sufficiently large to X-ray the viscera of 140 fish.

Discussion

It appears that this method can be used to test the survival of small fish (minimum practical size 2 gm.) when planted in nature. Since the thorium is not excreted, it will be detectable in the roentgenogram throughout the life of the fish provided that the concentration is sufficient.

Since our experiments show the material to be harmless in doses which are discernible by X-ray, and since these doses (0.5–1.0 mg. per fish) did not interfere with growth over a two month experimental period, we feel that this material can be used safely in a practical experiment.

Marking of the fish by clipping fins, dye, or metal tags involves some mutilation or disfiguration which may play a role in working against the normal survival of the fish in nature. The thorium method would not have this objection since it is invisible to the animal eye.

The experiment has not studied the detection of thorotrast after a small fish has reached adulthood. Certainly it is detectable after the animals have doubled their size as was shown in experiment 3.

The method might be applied to the tagging of small amphibia, reptiles, and mammals in migration studies.

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A Systematic Study of Two Carolinian Minnows, *Notropis scepticus* and *Notropis altipinnis*

By Carl L. Hubbs

THIS paper started as the description of a new species which on final study turns out to be inseparable from *Notropis scepticus*. Previously manuscript names had been based on two geographically aberrant series of *Notropis altipinnis*, a closely similar cyprinid likewise inhabiting the streams on the Atlantic slope of the Carolinas (Fig. 1). Though the supposed novelties have not stood a critical test, it is thought desirable to publish the data amassed in their study. The supplement to the inadequate differentiae that

have been published may help to avoid erroneous identifications in the future. Furthermore, an addition is made to the geographic as well as the systematic status of each species.

The study is based on all pertinent material in the collections of the United States National Museum, the University of Michigan Museum of Zoology, and the Museum of Comparative Zoology, and on a study of the extant types of *Alburnellus altipinnis* in the Philadelphia Academy of Natural Sciences. The cooperation of the officials of these institutions is gratefully acknowledged. We are also indebted to the late Prof. A. McLaren White, who, not long before his untimely death, collected most of the specimens of these species in the Museum of Zoology.

Notropis scepticus (Jordan and Gilbert)

Photogenis leucops (misidentification).—Cope, 1870: 463 (in part, "var. *aaaaa*"; characters; headwaters of the Catawba River; probably not the record for Neuse River near Raleigh).

Notropis photogenis (misidentification).—Jordan and Brayton, 1878: 11, 23, 85 (in part, the "pale form"; characters; Saluda River at Farr's Mills, west of Greenville, South Carolina).

Minnilus scepticus.—Jordan and Gilbert, 1883: 200–201 (original description, presumably based on Jordan and Brayton's material; comparisons; Saluda River, South Carolina—at Greenville, according to Jordan and Evermann, 1896: 296). True, 1883: 257 (South Carolina).

Notropis scepticus.—Jordan, 1885: 815; 1890: 132, 138 (characters; comparison; variation; synonymy; Reedy Fork of Haw River at Fulk's Mill, 11 miles north-northeast of Greensboro, North Carolina; Catawba River near Marion and John's River near Morgantown, North Carolina; Tiger River at Cleveland Shoals, and Pacolet River at Clifton Factory, 7 miles northeast of Spartanburg, South Carolina). Jordan and Evermann, 1896*a*: 258, 296 (description; comparisons; rivers of Carolina from the Cape Fear to the Santee); 1896*b*: 259 (same range). Smith, 1907: 90, 98–99 (synonymy; description; comparisons; published records). Fowler, 1922: 14–15, pl. 2, upper right fig. (description; southern, deep-bodied ally of *N. photogenis;* Pacolet River above Spartanburg, South Carolina). Jordan, 1929: 84–85 (characters; comparisons; North and South Carolina). Pratt, 1923: 83 (compiled). Jordan, Evermann and Clark, 1930: 123 (rivers of North Carolina from Cape Fear to the Santee). Fowler, 1935: 14, fig. 14 (Beaver Dam Creek 5 miles from Newberry, North Saluda River, Big Thickety Creek, Little Lynches River 5 miles southeast of Kershaw, and Turkey Creek, South Carolina). Pratt, 1935: 79 (compiled). Schrenkeisen, 1938: 121 (rivers of Carolinas).

Notropis skepticus (altered spelling).—Coker, 1925: 59 (pH 7.4; Paddy's Cr., Catawba system, North Carolina).

This species was first confused with *Photogenis leucops* (=*Notropis photogenis*), and has been regarded as hardly separable from that species, from *Notropis amoenus* (wrongly regarded by some as a subspecies of *N. photogenis*) and from *N. telescopus* (now interpreted as a subspecies of *N. ariommus*). The following comparisons suffice to show that *N. scepticus* is specifically distinct from the three other forms. Further study indicates complete separation also from each of the considerable number of other similar species.

When compared with *Notropis photogenis* (on status see Hubbs, 1926: 38, 45, and Hubbs and Lagler, 1941: 50, 56), *N. scepticus* is seen to differ consistently not only in the deeper body which has been mentioned by several

authors but also in other respects. The body is relatively thicker, and the lateral line more decurved; in consequence the greatest width is less instead of greater than the distance from the origin of the dorsal to the lateral line.

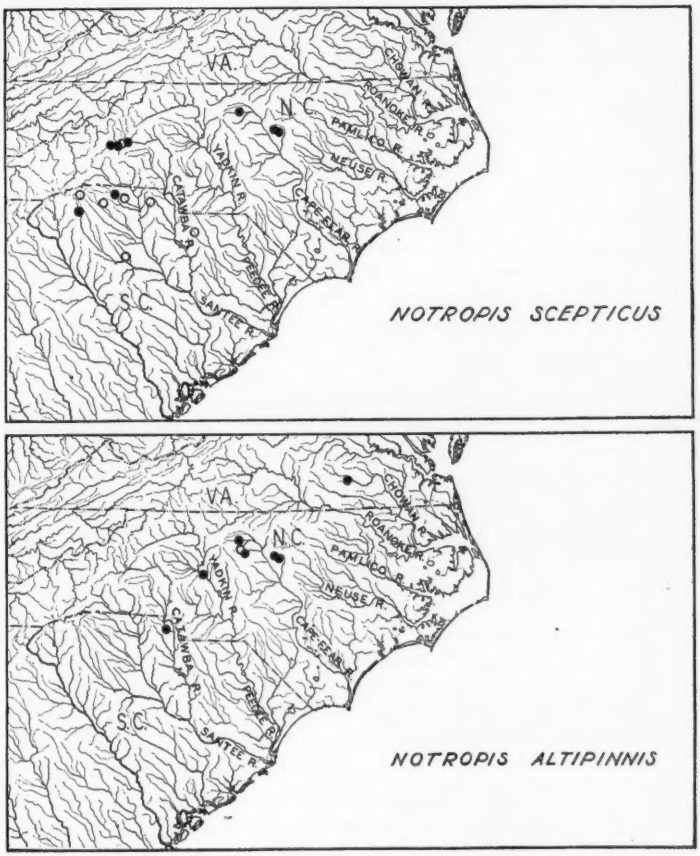

Fig. 1. Maps showing the record stations for *Notropis scepticus* and *Notropis altipinnis*.

The solid dots represent original stations, and old records confirmed by a re-examination of material. The hollow circles locate published records unconfirmed by a study of specimens. All published record stations are listed in the synonymies.

All the fins are larger; the height of the dorsal enters the dorsal–occiput interspace 1.25 to 1.54 times (1.38 on the average) rather than about 1.8 times. The mid-dorsal stripe is diffuse and indistinct, not clear-cut and almost jet-black. The pair of blackish crescents between the nostrils, diagnostic of *photogenis*, are not evident in *scepticus*. *N. photogenis* is confined to the Ohio River system.

Notropis scepticus differs from *N. amoenus* in the deeper body, the more anteriorly inserted dorsal fin (origin nearer front of eye than base of caudal, rather than the reverse), longer fins (height of dorsal almost always more than two-thirds, rather than only about one-half, the distance from origin of dorsal to occiput), etc. These species are hardly to be regarded as representative forms, and they apparently do not overlap in distribution: *scepticus* ranges northward to the Cape Fear drainage (Fig. 1) and *amoenus* southward to the Neuse River system in North Carolina (specimens examined from Little River at Goldsboro and from Crabtree Creek near Raleigh; records by Jordan, 1890: 129, by Evermann and Cox, 1895: 306, 309, and Smith, 1907: 99, and probably the report of Cope, 1870: 463, as *Photogenis leucops*, var. *aaaaa*).

The distinction between *Notropis scepticus* and *N. ariommus telescopus* is most trenchant, or at least most obvious, in the pigmentary system. The margins of the dorsal scale pockets are rather uniformly marked with fine dusky lines in *scepticus*, and the scales themselves have indistinct borders. In *N. a. telescopus* the pockets are broadly pigmented, and there are blackish lines around the free edges of these scales. The large size and transverse broadening of the anterior dorsal scales in *telescopus* accentuate this pattern. In that form the anterior lateral line pores are sharply set off with black pigment. The axial dark band is very distinct anteriorly, where it is paralleled above by a narrow dusky streak. Posteriorly the band is broad and deeply pigmented, and is separated from the dorsal color by a clear streak. The mid-dorsal dark stripe is almost as intense as in *photogenis*. None of these special color features of *telescopus* are well shown in *scepticus*.

As early as 1890 Jordan indicated that *Notropis scepticus* is subject to some local variation, as in the number of predorsal scales. The counts (Table 1) and measurements (Table 2) here presented confirm this view (some of the figures for the two specimens from the Catawba River tributary may owe their aberrancy to the small size of the specimens). Local forms will possibly be demonstrated when the species throughout its range is subjected to an intensive variational study. At present, however, it stands out as an essential unit, inhabiting the foothill and Piedmont streams of the Cape Fear, Peedee and Santee river systems, in North and South Carolina (Fig. 1).

Notropis altipinnis (Cope)

Alburnellus altipinnis.—Cope, 1870: 464–465 (original description; comparisons; Yadkin River, Roane [Rowan] County, North Carolina).

Minnilus altipinnis.—Jordan and Copeland, 1876: 154 (Yadkin River). Jordan and Gilbert, 1883: 195 (after Cope). True, 1883: 257 (probably to be found in South Carolina).

Notropis altipinnis.—Jordan and Brayton, 1878: 85 (Peedee system). Jordan, 1878: 422 (Yadkin River); 1885: 814; 1890: 132, 134 (comparisons; possibly identical with *N. chalybaeus;* Reedy Fork of Haw River at Fulk's Mill, 11 miles north-northeast of Greensboro; South Buffalo Creek about 5 miles southeast of Greensboro; Little Allemance Creek about 9 miles southeast of Greensboro, Cape Fear River system, North Carolina). Jordan and Evermann, 1896*a*: 257, 287 (synonymy; description; comparisons; clear streams of the pine woods, tributary to the Peedee and Cape Fear rivers); 1896*b*: 257 (synonymy; Yadkin, Peedee and Cape Fear rivers, North Carolina). Smith, 1907: 90, 96–97 (synonymy; description; comparisons; published records). Fowler,

1910: 286–287, pl. 19, fig. 37 (characters and figure of cotype); 1923: 16 (types listed). Pratt, 1923: 82 (compiled).

Hydrophlox altipinnis.—Jordan, 1929: 83–84 (characters; comparisons; streams of pine woods, Yadkin River to Cape Fear, North Carolina). Jordan, Evermann and Clark, 1930: 127 (Yadkin, Peedee and Cape Fear rivers, North Carolina). Pratt, 1935: 77–78 (compiled). Schrenkeisen, 1938: 126 (characters; Rowan Co., N. C.).

This species, inhabiting the outer part of the Piedmont from the Chowan River system in southeastern Virginia to the Catawba system in north-central South Carolina (Fig. 1), seems fully distinct from each of the multitude of other forms referable to *Notropis*.

Jordan (1890: 132) indicated having had such difficulty in separating *N. altipinnis* from *N. chalybaeus* that he was not certain of its distinctness. It is, however, quite different from that lowland species. The anal rays in *chalybaeus* typically number 8 instead of 10, and in formalin specimens the lateral band is much blacker than in *altipinnis*.

Notropis altipinnis has been indicated in the literature as very widely separated from *N. scepticus* and has even been referred to a different genus. There is no question of the specific distinctness of the two forms, for they show no tendency to intergrade where they occur together, but I see no justification for their reference to distinct genera. Apparently much reliance has been placed on general body form and color in referring species respectively to "*Hydrophlox*" or *Notropis* (*sensu stricto*), but such differences seem merely to reflect the usual habitat selection—which can hardly be relied upon for generic or subgeneric separation. In Jordan and Evermann's key (1896*a*: 257–258) *altipinnis* and *scepticus* are placed in different subgenera on the basis of the number of anal rays ("7 to 9, sometimes 10" as opposed to "11 or 12, rarely 9"). But the modal number of anal rays is 10 in each species (Table 3). Oddly, both of the extant types of *Alburnellus altipinnis* have 9 anal rays, and as these are the only available specimens from the Yadkin River and Cape Fear River system, it is possible that there is a typical subspecies with the anal rays usually 9. In other respects, including the large fins and the pigmentation of the head, the types agree with the other specimens herein identified as *N. altipinnis* (one of three nominal types represents another species of *Notropis*).

Notropis altipinnis in fact has many characters in common with *N. scepticus*. The most readily detected differences lie in the pigmentary system, which is very distinctive in *altipinnis*. This is especially true about the muzzle, where the melanophores are concentrated into a definite pattern. On the preorbital region there is a blackish blotch, more or less connected with the especially blackened anterior half of the lips, but bounded above by an almost unpigmented streak passing through the nostrils and thence forward around the tip of the snout just behind the rostral fold (in *scepticus* this region in front of the nostrils, in contrast, is especially darkened with thick-set color cells). The top of the head from above the eyes forward bears few melanophores, sometimes almost none, except on a blackish bar extending, with a slight forward curvature, from nostril to nostril, and in a blotch, more or less connected with the internarial bar, on the top of the snout anteriorly (in *scepticus* the top of the head is much more evenly peppered with melano-

TABLE 1

MEASUREMENTS OF *Notropis scepticus* AND *Notropis altipinnis*

Under each series there is given, for each character, the range of variation, and, in parentheses, the average. For methods of measuring see Hubbs and Lagler (1941).

	Notropis scepticus			*Notropis altipinnis*		
	A	B	C	D	E	F
Creek	Reedy Fork	Morgan	Tributary	Waqua	Morgan	Steele
Stream system	Cape Fear	Cape Fear	Santee	Chowan	Cape Fear	Santee
Location	Greensboro, N. C.	Orange Co., N. C.	Below Old Fort, N. C.	Rawlings, Va.	Orange Co., N. C.	Rock Hill, S. C.
Number of specimens	4	13	2	9	8	3
Standard length, mm.	52–54 (52.7)	39–59 (50.3)	41–43 (41.8)	31–45 (38.7)	34–40 (36.2)	28–33 (30.5)
Thousandths of standard length						
Predorsal length	521–542 (534.5)	506–547 (528)	517–536 (526.5)	502–548 (532)	522–550 (534)	520–529 (525)
Dorsal to occiput	314–323 (318)	298–335 (312)	317–326 (321.5)	323–345 (333)	311–355 (333)	317–321 (318)
Prepelvic length	490–515 (506.5)	491–521 (501)	485–491 (488)	451–488 (471)	463–502 (484)	458–466 (463)
Depth, greatest	238–252 (245)	235–286 (259)	212–225 (218.5)	196–234 (218)	210–266 (243)	196–207 (201)
Width, greatest	125–142 (136.5)	131–151 (140)	122–131 (126.5)	126–134 (131)	119–144 (132.5)	129–135 (132)
C. peduncle, depth	103–109 (105)	98–112 (103)	90–98 (94)	90–103 (97)	94–105 (100)	93–100 (95)
C. peduncle, length	193–213 (198.5)	178–213 (196)	203–208 (205.5)	211–230 (221)	204–238 (218)	244–256 (250)
Head, length	272–292 (283)	265–295 (278)	261–269 (265)	248–269 (257)	240–272 (255.5)	237–257 (249)
Head, depth	175–186 (181)	170–192 (181)	165–169 (167)	157–167 (163)	167–182 (175)	158–165 (162)
Snout, length	64–76 (72)	74–86 (80)	70–71 (70.5)	67–77 (72)	66–73 (69)	67–71 (69)
Eye, length	86–98 (91)	76–90 (83)	80–84 (82)	84–97 (89)	82–90 (75)	81–89 (86)
Interorbital, least fleshy width	79–92 (85)	79–98 (90)	83–85 (84)	83–94 (88)	80–88 (84.5)	81–90 (86)
Upper jaw, length	90–103 (97.5)	85–108 (97)	91–92 (91.5)	75–82 (80)	74–82 (79)	73–82 (78)
D. origin to lateral line	141–161 (152)	146–178 (158)	139–144 (141.5)	132–156 (146)	140–170 (157)	136–140 (138)
P_2 insertion to lateral line	72–81 (76)	77–110 (90)	77–90 (83.5)	69–79 (74)	73–101 (91)	58–73 (66)
Dorsal, height	234–251 (239)	199–235 (223)	....	237–270 (251)	238–260 (250)	244–254 (250)
Anal, height	172–187 (180)	160–183 (173)	....	192–211 (202)	187–215 (201)	194–212 (200)
Anal, basal length	142–162 (152)	134–164 (147)	148–154 (151)	134–166 (151)	140–169 (149)	131–146 (137)
Caudal, longest ray*	295 $(295)_1$	234–295 $(262)_{10}$	....	290–310 $(299)_5$	264–298 $(278)_5$	281–306 $(293.5)_2$
Pectoral, length	192–206 (201)	178–198 (188)	....	179–211 (197)	188–211 (199)	188–218 (200)
Pelvic, length	167–169 (168)	140–160 (154)	....	164–192 (179)	166–187 (175)	172–180 (177)

* Subscripts indicate the number of caudal fins measured in each series.

phores). In *altipinnis* the dusky lateral band on the body is broader and somewhat more prominent than in *scepticus* and is much more completely set off by a clear streak from the dorsal pigmentation.

TABLE 2

MEASUREMENTS AND COUNTS OF *Notropis scepticus* AND *Notropis altipinnis*

Under each series there is given, for each character, the range of variation, and, in parentheses, the average. For column headings see Table 1. For methods of counting see Hubbs and Lagler (1941).

	Notropis scepticus			*Notropis altipinnis*		
	A	B	C	D	E	F
Angle, top of head and premaxillary	57–63* (59.5)	56–65* (61.1)	56–57* (56.5)	63–71* (65.4)	66–76* (69.4)	65–68* (66.7)
Scales						
Above lateral line	6–7 (6.5)	6–7 (6.8)	6–6 (6.0)	5–7 (6.1)	6–6 (6.0)	7–7 (7.0)
Along lateral line	34–37 (35.2)	34–38 (35.7)	36–36 (36.0)	35–38 (36.4)	34–37 (35.5)	36–37 (36.3)
Below lateral line	4–5 (4.25)	4–7 (5.3)	4–4 (4.0)	3–4 (3.9)	4–5 (4.25)	4–4 (4.0)
P_2 to lateral line	3–4 (3.5)	3–4 (3.8)	3–4 (3.5)	3–3 (3.0)	3–4 (3.1)	3–3 (3.0)
Predorsal rows	15–16 (15.25)	14–18 (15.4)	15–16 (15.5)	16–18 (16.8)	15–17 (15.4)	16–21 (19.0)
Predorsal scales, crossing midline	15–18 (16.75)	16–21 (18.4)	18–20 (19.0)	20–26 (21.8)	16–20 (17.5)	18–22 (20.7)
Circumference, body	25–29 (27.0)	26–30 (27.9)	26–28 (27.0)	24–28 (25.7)	24–27 (25.1)	26–28 (26.7)
Above	13–15 (14.0)	13–15 (14.1)	13–14 (13.5)	13–15 (13.8)	13–14 (13.1)	14–15 (14.3)
Below	10–12 (11.0)	11–14 (11.8)	11–12 (11.5)	9–11 (9.7)	9–11 (10.0)	10–11 (10.3)
Circumference, C. peduncle	12–13 (12.75)	12–14 (13.3)	12–14 (13.0)	12–16 (12.7)	11–12 (11.9)	12–12 (12.0)
Above	5–6 (5.75)	5–7 (5.8)	5–7 (6.0)	5–7 (5.4)	4–5 (4.9)	5–5 (5.0)
Below	5–5 (5.0)	5–6 (5.1)	5–5 (5.0)	5–7 (5.2)	5–5 (5.0)	5–5 (5.0)
Fin rays						
Dorsal	8–8 (8.0)	8–8 (8.0)	8–8 (8.0)	8–8 (8.0)	8–8 (8.0)	8–8 (8.0)
Anal†	10–10 (10.0)	10–11 (10.1)	11–11 (11.0)	9–10 (9.9)	10–11 (10.1)	10–10 (10.0)
Pectoral	14–16 (15.5)	14–17 (15.5)	16–16 (16.0)	14–16 (14.9)	14–16 (15.0)	14–16 (14.7)
Pelvic	8–8 (8.0)	8–9 (8.1)	8–8 (8.0)	8–9 (8.1)	8–8 (8.0)	8–8 (8.0)

* The angle between the edge of the premaxillary and the line approximately tangential to the top profile of the head was measured with an "Arm Protractor and Goniometer."

† See also Table 3.

There are sharp differences too in the number, strength and arrangement of the nuptial tubercles. In *altipinnis* these structures are so minute as to be difficult to detect on the head and nape. They are well developed only along the pectoral rays, where they are biserial, with a tendency to become uniserial toward the extreme base of each ray and more or less triserial outward. In *scepticus* some of the tubercles are definitely enlarged, forming about four

rows on each mandible, a band on the cheek and preorbital region, and a row around the rostral edge; others are scattered among the more minute organs on the top of the head, and form a row around the margin of most of the scales in a nuchal triangle bounded by lines from the origin of the dorsal to the upper edge of each pectoral base. The hooklets on the pectoral fin of *scepticus*, forming 4 or 5 rows on each ray, greatly outnumber those of *altipinnis*.

TABLE 3

NUMBER OF ANAL RAYS IN *Notropis scepticus* AND *Notropis altipinnis*

	Number of Anal Rays						
	8	9	10	11	12	No.	Ave.
Notropis scepticus							
Cape Fear River system							
Vic. Greensboro, N. C.	...	...	4	...	...	4	10.00(?)
Morgan Cr., N. C.	...	2	31	9	...	42	10.17
Santee River system							
Catawba River and tributaries, N. C.	...	...	19	4	...	23	10.17
Pacolet River, S. C.	...	1	...	...	1	2	10.50(?)
Notropis altipinnis							
Chowan River system							
Waqua Cr., Va.	...	2	12	...	...	14	9.86
Cape Fear River system							
Vic. Greensboro, N. C.	...	3	20	7	...	30	10.13
Morgan Cr., N. C.	1	15	47	7	...	70	9.86
Peedee River system							
Yadkin R., N. C. (types)	...	2	...	...	...	2	9.00(?)
Santee River system							
Steele Cr., S. C.	...	...	3	...	...	3	10.00(?)
Totals							
Notropis scepticus	...	3	54	13	1	71	10.17
Notropis altipinnis	1	22	82	14	...	119	9.92

Though neither species seems to be brilliantly colored in life, *altipinnis* is apparently more colorful than *scepticus*. Jordan (1890: 132) reported that *altipinnis* has the "dorsal, anal, and caudal faintly reddish; snout yellowish in life; lower lip always dusky." One of the Morgan Creek specimens when received in formalin was described as having the "fins amber and snout orange-yellow (before black mark)."

There is obviously a difference in size. The adults of *N. altipinnis* run definitely smaller than those of *scepticus* (see Tables 1–2). Among the specimens examined the largest *altipinnis* measures 45 mm. in standard length, as contrasted with 73 mm. for *scepticus*.

The scales of *N. altipinnis* usually have more elevated exposed fields than those of *scepticus*. This is especially true of the scales along the lateral line anteriorly. In sixteen adults of each species the exposed surface of the fifth lateral line scale is 1.83 to 3.08 (average, 2.55) times as high as long (length measured along the axis of the lateral line) in *altipinnis* and 1.52 to 2.54 (average, 2.02) times as high as long in *scepticus*.

Still another difference lies in the development of the lateral line. Even

the larger adults of *N. altipinnis* often have some posterior pores missing; smaller adults may have the lateral line developed only in the fore part of the body, and the half-grown have only a few anterior pores. At comparable stages of maturity *scepticus* has a more nearly complete lateral line.

The mouth of *N. altipinnis* is more curved than that of *scepticus*, and, as shown in Tables 1 and 2, is smaller and more oblique (the angle measurements were made with an "Arm Protractor and Goniometer," with the arm laid along the premaxillary and the base of the instrument set on the tangent to the top of the head).

Table 1 further demonstrates that *N. altipinnis* is a slenderer fish than *scepticus*, and has a smaller head and longer (or higher) fins. Because of the smaller head the dorsal-to-occiput distance averages greater in *altipinnis* than in *scepticus*, and hence there is scarcely any difference between the species in the measurement of the height of the dorsal into this distance (the ratio for *altipinnis* is 1.19 to 1.41, averaging 1.32).

Other less consistent differences in proportionate measurements are also shown in Table 1. Indicated average differences in scale and fin-ray counts (Table 2) are rendered of doubtful validity by the small local variations in each form. In *altipinnis* as in *scepticus* it is possible that local subspecies may eventually be recognized. The three specimens of *altipinnis* from Steele Creek, Rock Hill, South Carolina (the first to be recorded for the Santee River system and for South Carolina), seem particularly aberrant. The specimens from Waqua Creek in the Chowan River system of Virginia (extending the range of the species to the northward) are also somewhat different from the North Carolina samples, but on the basis of available data it now seems unwise to distinguish them, even as subspecies.

The measurements and counts presented in Tables 1 and 2 are a refinement of the methods used by ichthyologists years ago, but largely abandoned in more recent times. It is proposed that they be resurrected, as making possible more complete, objective and precise comparisons. The measurements were made with dial calipers reading to 0.1 mm., with estimates to 0.01 mm., and transposed into thousandths of the total length by multiplying each figure by the reciprocal of the standard length.

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Ichthyological Notes

NOTES ON THE STING-RAY, *DASYATIS SAY* (LE SUEUR).—On July 1, 1941, we were fishing for weakfish in one of the several channels which separate Chincoteague Island from Cape Charles, Virginia. About 10 A.M. we first noticed large fish breaking the surface in from 5 to 20 feet of water. Several splashed not far from our boat, and we found that these were large rays disporting themselves on the surface. The water surface would break abruptly and the rays would swim rapidly in a straight line, the large pectoral fins beating rapidly, the tail sometimes curled and lashing out above the surface. They would swim thus for 100 feet or more at an estimated speed of 10 miles per hour; the speed would then slacken abruptly and after a few desultory strokes, the rays would settle below the surface. In the course of an hour we saw a dozen swimming on the surface in this manner: all appeared of large size. We also observed several individuals rising slowly to the surface within 10 feet of our boat, remaining thus for several minutes.

Two men fishing nearby hooked a large fish on the bottom. After a six minute struggle, they managed to bring to the boat one of these large rays, which had been snagged by two hooks, one on each side of the lip. Its large size and thrashing tail so disconcerted the fishermen that they were on the point of cutting the line when we approached, offering to remove the ray. It was accordingly landed in our boat, where inspection proved it to be *Dasyatis say*. The shock of capture stimulated the emission of a quantity of fluid from the vulva followed by the rapid delivery of five well developed young, probably within a week of parturition. Similar observations have been recorded by Gudger (Proc. Biol. Soc. Washington, 25, 1912: 144).

The weight of the sting-ray was estimated at 35 pounds. It had a total length of 47 inches, 27 inches wide over the pectorals and 23.5 inches long to the end of the ventrals, 4.7 inches (inside measurement) between the first spiracles, and the mouth (transverse) 2.5 inches. The young, quite destitute of color, averaged: length, 7 inches, width, 2.5 inches and tail, 4.7 inches. All had a yolk sac the size of a small bean. Both upper and lower tail fin were developed, but the spine was represented only by a rather pronounced swelling.

Only the left uterus was enlarged and functioning, a fact noted by Gudger (*loc. cit.*). The walls were thickly lined with deep red villi, a creamy material being imbedded between the villi.

No observations could be made on the food habits, as the stomach was empty. The specimen was hooked on the bottom in about 20 feet of water.

We were informed by the baymen that these large skates regularly enter the bays and channels in early July, their arrival made conspicuous by their habit of swimming and splashing on the surface.—W. J. HAMILTON, JR., and RALPH A. SMITH, *Cornell University, Ithaca, New York.*

CERATIAS MITSUKURII IN M.C.Z.—Between 1910 and 1912, while Mr. Garman was working on his Memoir on the sharks, Mr. Agassiz purchased for him a number of deep sea selachians from Alan Owston, of Yokohama. From time to time he purchased other specimens which he thought might be of interest. One of these proves to be a type, the presence of which, in this Museum, would never be expected, and since it is a rare and curious form it may be worthwhile to record its present whereabouts.

The type is that of *Ceratias* (*Paraceratias*) *mitsukurii* Tanaka. This was described in the Journal of the College of Science, Tokyo, 1908, (vol. 23, art. 13: 18). This specimen was in Alan Owston's private collection, No. 21251, and is now M.C.Z. No. 29855. Since the subgeneric name proposed by Tanaka is obviously that of a valid genus the form should stand as *Paraceratias mitsukurii* (Tanaka).—T. BARBOUR, *Museum of Comparative Zoology, Cambridge, Massachusetts.*

A RARE ABNORMALITY, A FISH WITH REVERSED SCALES.—On January 5, 1941, a fisherman caught a small redfish, *Sciaenops ocellatus* (Linnaeus), in a trammel net on the Estes Shore of Redfish Bay, Nueces County, Texas, which he noted, because of the fact that it would not slide through the net either way, apparently had the scales of the front and posterior part of the body turned in opposite directions.

The fish was given to me. Except for the squamation the specimen seems to be a normal redfish in all respects. It is in the young stage called by the fisherman a rat-red, being only 40.5 cm. in total length. The dorsal count is IX-I, 25 and that of the anal II, 8. Some scales were torn off in the net. The scale count along the lateral line is about 45.

The statement of the fisherman that the scales of the fish point in opposite directions on the front and posterior part of the body, broadly covers the case, but it is not an exact description. All scales of the caudal peduncle imbricate normally. Beginning under the posterior end of the soft dorsal the two middle rows of scales along the lateral line point forward. They increase in number and spread like a fan to a vertical line even with the front of the anal fin. From here to an area slightly anterior to the midpoint of the body axis, all scales above the lateral line point forward. There they come in contact, along an irregular vertical line, with the scales imbricating backwards. Below the lateral line, from the base of the anal fin the scales run forward to the anus. From there the boundary line turns diagonally upward to the meeting line with the backward pointing scales, described above. This line of forward pointing scales runs diagonally upward because between the anus and the pelvic fins the scales of the belly imbricate, not forward or backward, but dorsally, over a triangular region on each side. So the fish has scales pointing in three directions, those of the belly being at right angles to the other two. The rows of scales at right angles change their direction gradually as they approach the others and there is no sharp demarcation line, but a gradual transition from one direction to the other. In brief, the areas of normal scale direction are on the breast, the caudal peduncle and a somewhat rectangular region on the shoulder and anterior back. A few dorsal and ventral rows of scales between the caudal peduncle and the anal fin and mid-part of the soft dorsal imbricate normally.

There are two types of scales. One is large and apparently practically normal except for a few that are overly large, near the middle of the body. One of these is 2.1 cm. wide. The second type of scale is of uneven distribution and so small that they are not noticed at first. They are about 2 mm. wide. They point in the same direction as the adjacent large scales.

There are no signs of lesions. There is no frizzling or projection of the scales; therefore because of the mucous covering the fish probably swam as easily as its brethren.

The direction of scale imbrication seems to be an extremely constant character in fishes. Scales may be present or absent, but they are not known to imbricate forward in large areas, except sometimes after wounding and on the head of several cyprinodontids. This might indicate that reversed scales have an anti-survival effect. It was stated that the fish would not have been caught if the scales had not been reversed, for a large mesh net was used.

There seem to be no cases reported in the literature similar to the specimen described here and they must be extremely rare. The man who caught the fish, Mr. Willie Close, of Rockport, Texas, has fished this area commercially for about fifty years. He says that he saw one fish, a redfish, with the same abnormality about twenty years ago. The writer would surmise that if backward-scaled fish are noted elsewhere there is strong chance that it will be among the bizarre, artificially bred goldfish of the Orient.

If the scales on the specimen all grew at the same time, then it may be supposed that, whatever the mechanism determining the direction of imbrication, it is not closely dependent on the influence of scales in juxtaposition, for otherwise they would not point in opposite directions Furthermore, since the scales develop after the larva is in the swimming stage, the direction of imbrication is not altogether determined by the stimulus of water flow past the body. This leads to the not very illuminating conclusion that the condition causing reversed scales must have been present when the dermis was first formed in the embryo.—GORDON GUNTER, *Game, Fish and Oyster Commission, Rockport, Texas.*

Herpetological Notes

A COLLECTION OF SALAMANDERS FROM GEORGIA.—From December 19, 1940, until January 1, 1941, I collected salamanders at various localities throughout Georgia, securing a total of 146 specimens. These included 13 forms, one of which is new to the state, while two others represent the first definite records. The numbers in the following list refer to my private collection, and the specimens were collected by myself except as otherwise stated.

Necturus punctatus (Gibbes).—No. 1165, Spirit Creek at DeBruce, Richmond County, Georgia, December 30, 1940. As far as I have been able to ascertain, the only Georgia record for this species rests on a single juvenile specimen from the Ocmulgee River, near Macon. The 1939 edition of the "Check List" did not include Georgia in the range of *N. punctatus*. The present specimen was taken at night in Spirit Creek, a Coastal Plain tributary of the Savannah River. Among the fishes collected in the same area were *Elassoma zonatum, Aphredoderus sayanus, Fundulus nottii lineolatus,* and *Esox americanus.*

Triturus viridescens viridescens (Rafinesque).—Nos. 1145–1146, 4 miles west of Augusta, Richmond County, Georgia, December 28, 1940; Nos. 1147–1149, Athens, Clarke County, Georgia, December 19, 1940.

Ambystoma maculatum (Shaw).—Nos. 1125–1130, Augusta, Richmond County, Georgia, December 27, 1940, collected by W. T. Neill, Jr. and I. G. Rucker, Jr.

Ambystoma opacum (Gravenhorst).—Nos. 1057–1082, Augusta, Richmond County, Georgia, December 28, 1940, collected by W. T. Neill, Jr., and I. G. Rucker, Jr.

Ambystoma texanum (Matthes).—No. 1214, Augusta, Richmond County, Georgia, December 29, 1940. The narrowmouth salamander has been recorded from North Carolina and from Florida but this seems to be the first published record for Georgia. The specimen was taken from beneath a board in a heavily-wooded area that is subject to occasional inundation from a nearby creek.

Desmognathus fuscus fuscus (Rafinesque).—Nos. 1093-1113, Augusta, Richmond County, Georgia, December 28, 1940, collected by W. T. Neill, Jr., and I. G. Rucker, Jr.; Nos. 1150–1164, Atlanta, DeKalb County, Georgia, December 22, 1940, collected by W. T. Neill, Jr., and John W. Crenshaw, Jr.

Desmognathus fuscus auriculatus (Holbrook).—Nos. 1137–1140, DeBruce, Richmond County, Georgia, December 29, 1940.

Desmognathus phoca (Matthes).—Nos. 1175–1212, Atlanta, DeKalb County, Georgia, December 22, 1940, collected by W. T. Neill, Jr., John W. Crenshaw, Jr., and H. C. Gardner. This form has been previously recorded only from Demorest in Habersham County, Clayton and Tallulah Falls in Rabun County, and Toccoa in Stephens County, in the northeastern corner of the state.

Plethodon glutinosus (Green).—Nos. 1083–1092, Augusta, Richmond County, Georgia, December 28, 1940, collected by W. T. Neill, Jr., and I. G. Rucker, Jr.; No. 1136, DeBruce, Richmond County, Georgia, December 30, 1940.

Gyrinophilus porphyriticus danielsi (Blatchley).—Nos. 1166–1167, Stone Mountain, DeKalb County, Georgia, December 21, 1940, collected by John W. Crenshaw, Jr., and H. C. Gardner; No. 1168, Atlanta, DeKalb County, Georgia, December 22, 1940. Earlier herpetologists included Georgia in the range of this species, but more critical recent workers have expressed doubt concerning the southern records. Mr. Charles Wharton, of the Georgia State Museum, showed me a large adult of this form which he had collected at Stone Mountain. It seems to be fairly common at that locality.

Pseudotriton ruber ruber (Sonnini).—Nos. 1131–1134, Augusta, Richmond County, Georgia, December 27, 1940; No. 1135, DeBruce, Richmond County, Georgia, December 29, 1940.

Eurycea bislineata cirrigera (Green).—Nos. 1141–1144, DeBruce, Richmond County, Georgia, December 29, 1940.

Siren intermedia LeConte.—Nos. 1169–1174, DeBruce, Richmond County, Georgia, December 29, 1940.—WILFRED T. NEILL, JR., *Athens, Georgia.*

THE GREEN SALAMANDER, *ANEIDES AENEUS,* IN OHIO.—While hunting for signs of wood rats along the hills overlooking the Ohio River near Stouts, Adams County, Ohio, on July 4, 1939, the junior author chanced to find some low limestone cliffs the faces of which were weathered into small but deep pockets. During an examination of these pockets six specimens of the green salamander, *Aneides aeneus* (Cope), were found, the first to be taken in Ohio or anywhere north and west of the Ohio River. On September 30 we returned to this locality in company with Ralph Dury and Kenneth H. Doan and collected thirty-five additional specimens from the same habitat. Although we spent considerable time stripping bark from dead chestnut trees and turning logs in the woods nearby no *Aneides* were found away from the cliff. The formation at this locality seems to be the Cedarville dolomite, which, as has been pointed out by Braun (Ohio Biological Survey, Bull. 15, 1928) weathers in such a way as to produce numerous small irregularities of surface which support a characteristic flora. *Aneides* will doubtless be found elsewhere in this region since similar cliffs occur over a wide area.

Twice we found groups of young green salamanders in company with an adult female. In the first lot there were thirteen young, ranging from 22 to 24.8 mm. (mean 23.7) in length. The second consisted of seventeen young from 21.5 to 23.5 (mean 22.5) in length. These seem to be the smallest specimens on record. At least a part of the young of one group were in actual contact with the body of the adult female. This evidence seems to indicate that there is a period of post-embryonic brooding by the female before the young disperse.

None of the young shows any trace of gills and all exhibit the typical color pattern of the adult, although the light dorsal color is somewhat duller and more yellowish. As is usual in young salamanders the tail is relatively short. A striking feature of the young is the large size of the nostrils, the diameter of which is contained from 1.5 to 2 times in the distance from the nostril to the anterior angle of the eye. The same ratio in sub-adult and adult specimens varies from 6 to 9. Similarly developed nostrils are known to occur in the young of many species of *Oedipus* and of *Hydromantes* and are also retained by adults in some species of *Oedipus* (Dunn, Salamanders of the Family Plethodontidae, 1926). This character has been used by Dunn as evidence of close relationship between these two genera. Its occurrence in *Aneides,* or in any of the genera with attached tongues, seems not to have been noted previously. Insofar as this character provides a clue to phylogeny it suggests the relationship of *Oedipus* and *Hydromantes* to the *Plethodon-Aneides* section of the family rather than to the *Eurycea* section.—CHARLES F. WALKER, and WOODROW GOODPASTER, *Stone Laboratory, Put-in-Bay, Ohio,* and *Cincinnati Society of Natural History, Cincinnati, Ohio.*

THE COTTONMOUTH IN NORTHERN MISSOURI.—In the spring of 1939 I learned from Neil Lidstone, a materials inspector for the Missouri State Highway Commission, that snakes thought to be cottonmouth moccasins had been seen near Sampsel, Livingston County, Missouri. I spent a day on June 27, 1940, hunting for snakes in this area but found only *Natrix sipedon sipedon, Natrix grahamii,* and *Natrix erythrogaster transversa.* On October 19, however, a cottonmouth, *Agkistrodon piscivorous,* was found dead at the edge of highway US-36, 3 miles southwest of Chillicothe in Livingston County. The specimen is now No. 7816 in the collection of the Chicago Academy of Sciences. It is a female with a total length of 1000 mm., tail length 157 mm.; dorsal scale rows 25; ventrals 137, caudals 44; supralabials 6–8, infralabials 10–10.

Livingston County, in the vicinity of Chillicothe and Sampsel, is rolling prairie with some marshy areas. The elevation at Chillicothe is 765 feet. The region in which the snake was found is in the broad bottom land of the Grand River, at a point about a mile from the river where the highway crosses a slough thought to be a former course of the stream.

It has long been known that the cottonmouth inhabits the lowlands of southeastern Missouri and recently it has been found in the Missouri Ozarks. This record from Chillicothe extends the range more than a hundred miles to the north and into an entirely different habitat.—PAUL ANDERSON, *604 W. College St., Independence, Missouri.*

VARIATION OF THE SALAMANDER *PSEUDOTRITON RUBER*.—While working over the *Pseudotriton* material in the collection of the University of Michigan Museum of Zoology I came across two specimens that seem to be of especial interest. One (UMMZ No. 75545) is an example of *P. r. nitidus* Dunn collected near Swannanoa in Buncombe County, North Carolina, and the other (UMMZ No. 81053) is a *P. r. schencki* (Brimley) from Junaluska, Cherokee County, North Carolina. Although the usual dorsal pattern of adult salamanders of these two subspecies is a light ground with many dark markings of subequal size, these two specimens differ from the typical members of their respective groups in having a dorsal pattern with both large and small markings, as may be seen in the accompanying photograph.

Fig. 1. Specimens of two races of *Pseudotriton ruber* with parallel divergence from the typical color pattern: *P. ruber nitidus*, right, and *P. ruber schencki*, left.

It is not likely that these two individuals represent another form of southern Blue Ridge *Pseudotriton*, for between the localities at which these salamanders were taken the wide flat valley of the French Broad River apparently limits free protoplasmic interchange between individuals of *P. r. nitidus* from the north and *P. r. schencki* from the south. Moreover they do not seem to differ from other members of their respective races except in the character mentioned. The parallel changes from the normal condition in these closely allied races may be the result of a similar disturbance in the genetic make-up of both specimens such as, for example, the similar mutation of a dorsal pattern-affecting gene at the same locus; or the similar patterns might conceivably be due to independent mutations of different genes at different loci which produce the same effect.—ARNOLD B. GROBMAN, *Biological Laboratories, University of Rochester, Rochester, New York.*

THE INCUBATION PERIOD OF THE SNAPPING TURTLE.—A good size snapping turtle, *Chelydra serpentina* (Linnaeus), was observed laying eggs in the bank of a marsh on the morning of June 11, 1939, near Ithaca, N.Y. In the afternoon of this same day thirty-two eggs were removed from this place. These eggs were placed in a closed terrarium together with a glass of water. The eggs were not covered by earth and a considerable amount of algae collected on the outsides of many of them. The temperature was that of the room, varying from 58°F to 98°F. The fifteen eggs kept in this manner hatched September 4 and 5, thus making their incubation period 85 or 86 days.

A hatchling specimen measured 29 mm. from the anterior to the posterior extremity of the carapace, and 27 mm. across at the broadest point. The center of the plastron is occupied by a tube-like "umbilicus" about an inch long. While the eyes are usually kept closed at hatching they are occasionally opened. When water was placed in the container the hatchlings entered it without hesitation, but showed no interest in bits of meat placed in the water. They showed no inclination to bite or objection to being handled.

At hatching there is a nearly round opening in the shell slightly larger than the head, 9 mm. across, through which the "bill" is extended. At the anterior tip of the mandible is a small whitish tubercle, hard and pointed, located just beneath the two openings of the nares.

I am indebted to Dr. J. C. Howell for taking some of the above notes.—J. SOUTHGATE Y. HOYT, *Fernow Hall, Cornell University, Ithaca, New York.*

HIGH SPEED ATTAINED BY *CNEMIDOPHORUS SEXLINEATUS*.—While in the field near McCormick, S.D., in the summer of 1940 I chanced upon a six-lined lizard running down the side of a clay road. I was in the government truck at the time and realized that the lizard was going fast before me. I accelerated the truck so as to catch up to the animal, but soon realized that it was also gaining speed, and when the speed of 18 miles per hour, as checked on the speedometer, was finally attained, I had just caught up with the lizard and it was holding its own beside me. At this speed it traveled along the road keeping abreast of my front wheel for more than a minute, after which it suddenly darted off the road into the underbrush. It ran on all four legs but carried the body raised as high from the ground as the length of the legs permitted.—J. SOUTHGATE Y. HOYT, *Fernow Hall, Cornell University, Ithaca, New York.*

REFRACTION OF LIGHT BY AMPHIBIAN EGG JELLY.—The statement is sometimes made that one function of the gelatinous coats surrounding amphibian eggs is to focus light upon the eggs, thereby increasing the supply of heat. Attributing refractive powers to the jelly is probably the result of an understandable, but fallacious assumption that greater physical consistency necessarily entails greater optical density. If any considerable refraction occurred at the surface of the jelly mass, or at the surfaces of the inner capsules, it would distort the appearance of the interior of the mass. On the contrary, as one looks through a clutch of frog or salamander eggs immersed in water, one can see the embryos in the interior entirely undistorted. Refractive indices offer conclusive proof that there is no significant refraction at the water-jelly surface or the surfaces between the capsules and the outer layer of jelly. Indices at 26°C were as follows (estimated in the fourth decimal place):

Pond water from which the eggs were taken	1.3322
Ambystoma maculatum, outer jelly layer	1.3342
Ambystoma maculatum, inner capsule with capsular fluid	1.3332
Rana sylvatica, whole jelly	1.3332

In answer to an inquiry, Dr. Oscar W. Richards has kindly measured the refraction for the eggs of *Ambystoma maculatum* Shaw at 28°C, and reports them as: outside jelly, 1.3335; capsule, 1.3334; capsular fluid, 1.3330. To make the insignificance of the refraction more graphic, one can calculate the focal distance of the illuminated half of a jelly envelope, treating it as a hemispherical lens one-eighth inch in radius. Using the refraction at the surface between frog egg jelly and water, we find that such a lens would bring light to a focus about 1000 feet away! Whatever may be the functions of the gelatinous coats enveloping amphibian eggs, focussing light is not one of them.—IVOR CORNMAN and NATHANIEL GRIER, *University of Michigan, Ann Arbor, Michigan.*

THE OCCURRENCE OF *PSEUDOTRITON MONTANUS MONTANUS* IN MARYLAND.—There are apparently no published records for *Pseudotriton montanus montanus* (Baird) from Maryland. It is possible, however, that the lack of records of *montanus* may be due to the misidentification of specimens as *ruber ruber*, since I recently found three specimens of *montanus* catalogued as *ruber* in the collection of the Natural History Society of Maryland.

The only published record of *montanus* from a locality near Maryland seems to be that of Brady (COPEIA, 130, 1924: 54) who reported a specimen collected at Mt. Vernon, Fairfax County, Virginia. This locality, in the tidal marshes of the Potomac River, is across the river from Maryland.

The following Maryland records are based on specimens in the collection of the United States National Museum, made available through the courtesy of Dr. Doris M. Cochran; specimens in the collection of the Fish and Wildlife Service of the United States Department of the Interior, secured through the generosity of Mr. F. M. Uhler of the Food Habits Division; three specimens in the collection of The Natural History Society of Maryland; and a specimen in the author's private collection.

The United States National Museum specimens (USNM No. 101427–28) were collected in May, 1936, at Priest's Bridge, Anne Arundel County, by Messrs. East, Aschmeier, and Brown.

The specimens in the Fish and Wildlife Service collection were collected as follows: Port Tobacco Village, Charles County, March 31, 1940, No. H8894; Cash Lake, Patuxent Refuge, Prince Georges County, April 11, 1940, No. H9070 (this specimen has now been skeletonized); and Branchville, Prince Georges County, no date, No. H1022.

The specimens from the collection of the Natural History Society of Maryland were from Western Run Parkway, Baltimore City, collected August 12, 1940.

The author's specimen, which prompted this report, was collected in May, 1937, near Bowens, Calvert County. This specimen was found under a board in soft mud in a cypress swamp. It sought to escape by crawling into a burrow.

Most of the recent records for *P. m. montanus* emphasize the fact that, notwithstanding its specific name, which alludes to the type locality at South Mountain near Carlisle, Cumberland County, Pennsylvania, the species seems to prefer a lowland habitat. Brady (*loc. cit.*), in recording the specimen from Mt. Vernon, Virginia, in the Coastal Plain, states that most records point to a Piedmont Plateau range. Trapido and Wright (COPEIA, 1940: 133), in reporting *P. m. montanus* from West Virginia, remark on the lowland aspect of the distribution of the species in that state.

The Maryland records herein reported emphasize the lowland distribution of the species. The localities mentioned, except those from the Baltimore region, are from the Coastal Plain. The latter specimens were from the Piedmont Plateau where it borders the Coastal Plain.—J. A. FOWLER, *Biology Department, The George Washington University, Washington, D.C.*

EXTENSION OF RANGE OF THE WESTERN WORM SNAKE.—In a study of the food habits of predators through the analyses of droppings and stomach contents, it is especially satisfying to discover the remains of some animal not known to occur in the region studied. Such a discovery was made in the analyses of more than 7,000 skats of predators collected by the Forest Service and the Biological Survey in an investigation of the relation of predatory animals to deer in the brushy, mountainous area of Los Padres National Forest, Santa Barbara County, California.[1]

A coyote skat, about a week old when collected near Little Caliente Creek, 5 miles east of Gibraltar Dam, on September 10, 1937, contained the little digested remains of a western worm snake (*Leptotyphlops humilis humilis*). The specimen was sent to Mr. L. M. Klauber in San Diego, who confirmed the identification and informed us that the specimen represented a new northwestern record for the species.

Previous to this occurrence, there was no record of the western worm snake north of Los Angeles County. The Los Angeles County records for this snake in the possession of Mr. Klauber are as follows: Chatsworth Park, Elizabeth Canyon near Saugus, and

[1] Assistance in the examination of this material was furnished by Works Progress Administration Official Project No. 8841.

Dalton Canyon. This latest record, then, extends the range of *Leptotyphlops humilis humilis* at least 70 miles northward.—Howard Twining and E. E. Horn, *U.S. Department of the Interior, Fish and Wildlife Service, Berkeley, California.*

NOTES ON THE BROWN-SHOULDERED UTA.—During studies of lizard food habits, begun during 1930, opportunities have been afforded to make various field and laboratory observations.

The subspecies *Uta stansburiana stansburiana* (Baird and Girard), has rarely been observed to climb up into brush, or to make conspicuous jumps. On September 14, 1934, while collecting lizards near Timpie in Tooele County, an adult female was driven out of a Russian thistle; she ran for approximately one foot, then jumped about 16 inches, passing over a small sharp-sided ravine slightly more than 12 inches wide, clearing the edges by 2 inches or more on each side.

The stomach of this specimen was found to contain 15 adult and 4 nymphal beet leafhoppers, 6 false cinch bugs, 1 *Lygus hesperus,* 1 diamond-back moth larva, and 7 ants, all injurious insects.

High lizard populations in the range area of Tooele County, west of Delle, breeding grounds for the beet leafhopper, evidently played an important rôle in the control of this insect during the late summer and fall of 1931. Here the shadscale areas were dry, and large numbers of *Uta s. stansburiana* came to the roadside fringes and to occasional larger patches of Russian thistle to feed on the abundance of insects which sought shelter within, or fed on the dense growth of this plant. Sometimes several lizards would be found beneath a single plant. Under favorable conditions, shortly before dusk, the writer sometimes could collect these small lizards almost as fast as he could walk along the Russian thistle strip, shooting the specimens with dust-shot from a .22 repeating rifle, picking up the specimens and reloading the gun. On such occasions it was estimated that more than a hundred lizards per acre were present on the medium to small patches of Russian thistle, with the equivalent of 250 to more than a thousand per acre on the narrow roadside fringe, where the lizards converged to feed, coming from surrounding large areas of shadscale, sagebrush and greasewood. During hot, cloudless midday, these lizards often appeared to be scarce on these same areas, although usually they were easily found during morning and evening feeding periods when air and soil temperatures were favorable. Following a shower, the writer and two assistants spent a warm, cloudy August day collecting lizards in Skull Valley, Tooele County; approximately 500 lizards were taken at stops made chiefly between Timpie and Orr's Ranch, a distance of 36 miles.

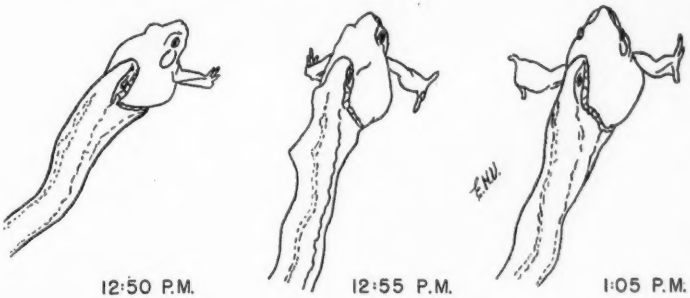
Body parts of hard bodied insects are quite resistant to lizard digestion. Heads and sometimes parts of or most of the bodies of ants, bees, beetles, bugs and some other insects were readily recognizable in the intestine, and even in a large intestinal "bulge" often found just in front of the rectum. Even after such material has been passed as feces, recognition of such parts to order, family, and, of some well known insects, to species, was readily possible.

The digestive tract of a mature female *Uta s. stansburiana,* collected among greasewood at Timpie on August 5, 1940, was examined. Recognizable material in the stomach consisted of: 1 andrenid bee with heads and parts of the bodies of 6 others; 1 internal hymenopterous parasite, found protruding from the broken abdomen of one of the andrenid bees; 1 nymphal leafhopper. Material removed from bulges along the small intestine below the stomach contained: head, thorax and front wings of 3 false cinch bug adults; head and attached body cuticula of 2 lepidopterous larvae; distal end of abdomen and scutellum of a beet leafhopper adult female; heads of 2 small wild bees (probably Andrenidae) besides numerous wild bee legs and body sclerites; 3 ant heads plus legs and body fragments; also a few beetle fragments. Recognizable in a rather large intestinal bulge just preceding the rectum were: heads of 9 small bees, 8 hymenopterous front wings and 4 hind wings, and portions of 3 bodies (apparently Andrenidae); 1 chalcid wing; 3 ant heads; numerous body sclerites and leg parts of bees and ants.

Leaves of succulent Russian thistle plants were found in the stomachs of several brown-shouldered utas collected at Timpie on August 5, 1940. It is believed that this material was taken largely by accident, as the lizards seized insect prey resting on the plant.—George F. Knowlton, *Utah Agricultural Experiment Station, Logan, Utah.*

DEFENSIVE INFLATION OF THE BODY IN *BUFO BOREAS HALOPHILUS*.—Inflation of the body by a specimen of *Bufo boreas halophilus* as a defense against being swallowed by a garter snake (*Thamnophis ordinoides* subsp.), was observed near the south end of Little Walker Lake, Mono County, California, on May 15, 1940, during my survey work for the California Division of Fish and Game at that lake.

The garter snake was seen attempting to devour the toad in question at 12:50 P.M. The snake had swallowed the legs but seemed unable to go farther. The toad kept its abdomen and thorax constantly inflated, and, try as it would, the snake could not engulf the body beyond the hind quarters. At intervals the toad tried to struggle free from the grasp of its captor, but the teeth and distended muscular jaws of the snake held it securely. The snake attempted repeatedly to change its hold, and at the same time constricted the body of the toad in the attempt to force down the impeding inflation. As long as the toad remained puffed up the garter snake seemed unable to swallow its prey. Accompanying field sketches show the attitudes of the toad and its enemy at three different times during the struggle.



Once when the snake opened its mouth widely droplets of blood were seen on the back of the toad from punctures by the fine recurved teeth. When disturbed the garter snake was able to lift the prey above the ground and to move quickly along with the toad in its mouth. The snake's body seemed to remain in two principal loops well behind the head, possibly to maintain a supporting purchase with the body during the swallowing process. The region of the body immediately behind the head was much distorted by the compressed hind legs of the toad.

The toad was released only with considerable difficulty by forcing the jaws of the garter snake partly open. As soon as the toad was partly freed the snake would again take firm hold on the hind quarters of the amphibian. At 1:15 P.M., the toad was pulled free of the snake's grasp and crawled weakly away. The garter snake did not again attempt to capture the toad, once the latter was completely free.—ELDEN H. VESTAL, *California Division of Fish and Game, June Lake, Mono County, California.*

SOME AMPHIBIANS AND REPTILES FROM SOUTHERN ILLINOIS.—Vacation periods spent on a farm near Standard City, Macoupin County, Illinois, in the summers of 1939 and 1940, provided an opportunity to make collections of amphibians and reptiles. The majority of the specimens collected have been presented to Field Museum of Natural History. Curator Karl P. Schmidt, of that institution, has pointed out to me that our knowledge of the herpetology of Illinois is based chiefly on collections from the southern part of the state (south of Carbondale), and from the Chicago Region. Macoupin County, about 50 miles northeast of St. Louis, helps to fill this gap, and the following notes have been drawn up at Mr. Schmidt's suggestion.

Ambystoma maculatum (Shaw).—Two, found under boards on the ground.

Bufo fowleri Hinckley.—Four, near buildings and in corn field.

Acris crepitans Baird.—Nine, near ponds and streams.

Rana catesbeiana Shaw.—One, on road about 30 yards from a small stream, after a heavy rain.

Rana sphenocephala (Cope).—Twelve, in ponds and streams. In order to test the relations of the Macoupin County specimens to the leopard frog of the Chicago Region and to specimens recorded as *Rana sphenocephala* from southern Illinois, I have measured the length of the body and the tibia in all of the Illinois specimens available in Field Museum. I find that for uniformity of result it is necessary to straighten the body as completely as possible with the thumb and fingers while measuring with calipers. The length of the tibial part of the leg varies significantly with the amount of flexure, and I have made this measurement with the foot tightly drawn up. The tibia and body measurements expressed as the t/b ratio are as follows:

	No. of specimens	Extremes	Average
Chicago Region — *pipiens*	62	.50 — .61	.55
Southern Illinois — *sphenocephala*	53	.53 — .62	.58
Macoupin County specimens	10	.54 — .63	.59

I concluded that the Macoupin County leopard frog should be referred to *sphenocephala*, the longer-legged and more sharp-snouted form of the southeastern United States.

The proportionate leg length appears to be significantly different in the sexes, four males from Macoupin County having the t/b ratios .54, .56, .55, and .58, while five females from the same locality have ratios of .57, .61, .62, .63, and .63. This difference of the sexes has been tested against a series of ten males and an equal number of females from the Chicago Region. The extremes for these males are .51 – .56, the average is .54; for the females, extremes are .53 – .60, average, .56.

The fact that my average for t/b for Macoupin County specimens is a little higher than for specimens from southern Illinois is not in accordance with expectation (Schmidt, 1938, Zool. Ser. Field Mus. Nat. Hist., 20: 380). Fresh specimens and more uniformly preserved ones are necessary for further study of this matter.

Heterodon contortrix (Linnaeus).—Three specimens; two males and one female. Taken near stream. In the two males the ventrals number 132 and 134; the caudals, 56 and 49, respectively. The female has 140 ventrals and 39 caudals.

Coluber constrictor flaviventris (Say).—Two females, in pasture. Ventrals, 178 and 182; caudals, 81 and 89, respectively.

Natrix sipedon sipedon (Linnaeus).—One juvenile male, taken in creek. Ventrals, 141; caudals, 79.

Thamnophis sirtalis sirtalis (Linnaeus).—Two females, near pond. In one there are 155 ventrals and 70 caudals; the other has 145 ventrals, but the tail is broken.

Chelydra serpentina (Linnaeus).—One, in pond.

Terrapene carolina (Linnaeus).—Seven taken in wet places in woods during very warm weather.

Terrapene ornata (Agassiz).—Two, in pasture and in cornfield. In northern Illinois this species seems to be confined to sandy areas, but such is not the case in Macoupin County.—David W. Owens, *Flossmoor, Illinois.*

AMBYSTOMA TALPOIDEUM IN OKLAHOMA.—A young specimen of *Ambystoma talpoideum* was collected from under a log in a swamp near Little River about 7 miles northeast of Idabel, Oklahoma, on August 29, 1937. This seems to be the first Oklahoma record for the species, and it extends the known range some 200 miles to the west. The locality at which the specimen was collected lies in the Mississippi biotic district of Oklahoma, which constitutes a part of the Gulf Coastal Plain. This part of Oklahoma has extensive swamp lands and supports an amphibian fauna quite unlike that of the more arid parts of the state.

I am indebted to Dr. E. R. Dunn, of Haverford College, for verification of my identification of the specimen as *Ambystoma talpoideum*.—Albert P. Blair, *Department of Zoology, Columbia University, New York City.*

Reviews and Comments

THE HERPETOLOGY OF HISPANIOLA. By Doris M. Cochran. U. S. National Museum, Bull. 177, 1941: VII + 398, 12 pls., 120 text figs. 70¢—So it is out at last! No disappointment after the long waiting. The wealth of detail, the precise synonymies, the lists of specimens examined and the impeccable descriptions, the excellent keys and the discriminating use of trinominals will make it forever easy to identify material from this area in the future and that it surely never has been in the past. I someway do not agree with the author that it is likely that there will be any great number of additions to the fauna made in the future. I suspect this excellent handbook will be up-to-date for many a long day.

Miss Cochran eschews flamboyancy of expression at all times and there are occasions when we miss those bits of narrative which personal familiarity with the species in the field inclines one to run in here and there from time to time. But this is not as important as the fact that I must take terrible issue with her for not jumping upon the table, smashing some china, pinching the cat's tail, and generally making it more noticeable that her drawings are just about the best things of the sort that have ever appeared in the history of herpetology. I know of no one who can draw a frog and show every detail whereby that frog differs from other frogs with nothing thrown in to confuse the issue. The drawings throughout this book are superlatively excellent.

Then, of course, and we can whisper it without being indiscreet, there is one other reason why this paper is better than any one of the rest of us could ever have made it and that is because of the omniscient presence which stood behind her chair, never meddlesome, never interfering, but always ready with more pertinent and helpful information than is possessed by any other generous soul on earth.

If I were to try and give a resumé of the mass of data compressed into the three hundred and ninety odd pages of this book I would make a poor fist of it now. The tables given on pages three, four, five and six epitomize the distribution data, and the nomenclatorial conclusions. He who runs may read and I for one never put this paper down after I received it until after I had cut the last page.

At this point, however, I am constrained to shed a tear. Years ago by dint of bribery, cajolery and promises of sundry sorts, I persuaded the more decorative portion of my family to undertake a long journey, on an old friend's yacht, around Hispaniola among other islands, with promises to help garner such store of small game as might be forthcoming. Fortune favored the brave and at the cost of numberless stocking runs, and it must be confessed some honest sweat, we managed to assemble quite an astounding number of herpetological novelties. I have been for years gloating over what an impressive showing the statement of these results would make in this report, thinking perhaps that they might appear "leg. Barbour ux. et pull.", thus tersely and in truly classical form commemorating this unique occasion. What was my sadness on reading this tome to see only the words "Utowana exp." time and time again. Thus a more personal record of these momentous occasions lies unrecorded for all time.

The only other matter that gives me some concern is one that breaths of possible danger to the author. When "El Benemerito" decided to change the four hundred year old name of the City of Holy Sunday to that of his own euphonious appellation, he was of course, then as now, bursting with pride and I have a feeling that when he sees that Miss Cochran has written Frujillo City several times in this book he will set a watch for her and if she ever turns up in the capitol of the sovereign republic I strongly advise her to creep around the walls like the muskrat in Kipling's "Jungle Book" and so avoid the pillory or the stocks.—Thomas Barbour, *Museum of Comparative Zoology, Cambridge, Massachusetts.*

SYSTEMA NATURAE. By Carolus Linnaeus. Tenth edition, Vol. 1 (the animal kingdom).—This rare volume has been reprinted in facsimile by the British Museum (Natural History), and is available at the low price of 10/6.

INAGUA—WHICH IS THE NAME OF A VERY LONELY AND NEARLY FORGOTTEN ISLAND. By Gilbert C. Klingel. Dodd Mead & Company, New York: xii + 385, 32 half-tone pls. $3.00.—Inagua is by no means a forgotten name to herpetologists, for this island harbors the largest and most distinctive assemblage of reptiles of all the Bahamas, and other expeditions before and since Mr. Klingel's ill-fated one in the yawl "Basilisk" have collected them. Something of the substance of the present book is known to readers of *Natural History* (Klingel, 1932, Nat. Hist., 32: 42–55, and Noble, 1931, *idem*, 31: 93–100), and the technical report on the herpetological collection is by Noble and Klingel (1933, Amer. Mus. Novit., 549: 1–25, 5 figs). The story of the wreck with which the Klingel expedition began its stay on Inagua is now told in greater detail. It is a thrilling one, but it may be doubted if even such a catalogue of hardship and disaster can reduce the romantic charm of a cruise in a small sailing vessel among tropical islands.

The charm of such a cruise is much greater when there is a serious scientific end in view. There can be no question that the great problem of species formation on islands deserved renewed and exact studies such as were planned for the West Indian lizards by Dr. Noble and Mr. Klingel. Their project was a sound one, and the shipwreck which so completely altered their plans was a disaster to science as well as to Messrs. Klingel and Coleman. The reviewer feels also that Mr. Klingel's interest, while plainly that of an amateur, is a very genuine one, which, with better fortune, might have developed into that of a first-rate naturalist. Museums and allied institutions are constantly indebted to such seriously interested patrons and allies.

The account of Inagua is disappointing as to its natural history and as to the description of the "web of life" which Mr. Klingel attempts. It would have been pleasant to read some account of the collectors who visited Inagua before him, and of those who have made collections there since. Since his principal scientific interest was herpetological, we might legitimately expect a more comprehensive view of the reptilian life of the island.

The book is marred, to the shame of the publishers, by quite unnecessary slips, such as "specie" for species, "genera" for genus, and "bitten" for stung. The lack of an index will annoy the more serious reader.

There is a good deal of information about the flamingos of Inagua and about its distinctive humming bird. The account of diving with a helmet and the description of the coral reef scenery with its fishes and octopi is vivid and suggestive.—Karl P. Schmidt, *Field Museum of Natural History, Chicago, Illinois.*

ADAPTIVE COLORATION IN ANIMALS. By Hugh B. Cott. Oxford Universisty Press, New York, 1940: XXXII + 508, col. front., 48 pls., 84 text figs.—Herpetologists who have read Hugh Cott's successive contributions to their literature from his explorations in the Amazonian rain-forest and in the marshes of the Zambezi will be well aware of his long-continued interest in the environmental adjustments of animals and in animal coloration in particular. They will also know that he stands boldly against the school of "anti-adaptationists" which is somewhat fashionable in university circles.

The present book has threefold roots, in the author's personal observation in nature of rich faunae, in an extensive exploration of the literature (685 titles are cited), and in his own experimental studies on the effectiveness of warning coloration. The phenomena under consideration are analyzed in accordance with physical and optical principles, as well as in relation to their living environment.

Only those who are averse to the adaptational explanations of animal coloration on *a priori* grounds will fail, after reading Dr. Cott's review of the subject, to be convinced that color and pattern are factors of major importance in natural selection, and hence in the evolution of animals. His careful consideration of the various objections raised by critics of the adaptational interpretation is reminiscent of Darwin's mode of presentation in the *Origin of Species.*

The specific interest of the present work to herpetologists and ichthyologists is great, since about half of the illustrations are drawn from these groups. It is disappointing to find that Dr. Cott has missed the recent studies on the courtship of lizards by Noble and others. The work is unnecessarily marred by erratic nomenclature, which is partly but not consistently Boulengerian. The reviewer agrees with the omission of the supposed

mimicry among coral snakes; it is disappointing to find that Dr. Cott has not eliminated the famous Brazilian fulgorid bug which is supposed to resemble a crocodilian.

Dr. Cott's wealth of instance points the way to further experimental and observational investigation, which obviously promises significant results.—KARL P. SCHMIDT, *Field Museum of Natural History, Chicago, Illinois.*

THE FISHES OF NEW ZEALAND. By W. J. Phillipps. Vo. 1, viii + 87, 45 figs. Thomas Avery & Sons, Ltd., New Plymouth, New Zealand. 1940.—This first volume of a new work on New Zealand fishes is sincerely welcomed. No manual of New Zealand fishes has appeared since 1886, and Dr. Phillipps' work will form a very helpful guide. The present volume covers the Isospondylous fishes, including the interesting Antipodal galaxiids and the introduced salmon and trout, and the swordfishes and marlins. Much data are given on habits, utility of the species as food, and Maori fishing methods.

But if reviews are to fulfill their function, the reviewer must be critical, and there is much in this book that will not please systematic ichthyologists who must occasionally refer to New Zealand fishes in the course of their work. Most striking to the reviewer is the fact that the remarkable but not exceptionally large New Zealand fish fauna has never been subjected to a thoroughgoing systematic revision, either in one volume or group by group in shorter papers. Handbooks there have been, but, with the exception of extremely scattered reports on collections and descriptions of new species, there is no firm groundwork of critical descriptive taxonomy upon which alone really accurate manuals may be based. The present work is neither a complete systematic handbook nor an out-and-out popular manual. It almost entirely omits keys and descriptions, depending to a large extent on figures for identification, yet contains the description of a new species and gives fin and scale formulae which are unintelligible to the layman since they are nowhere explained. A few scientific names are misspelled and others in the figure legends do not agree with those in the text. The only key in the book is a copy of Regan's key to New Zealand *Galaxias* and this does not agree with the textual treatment; nor is it possible to figure out what disposition the author makes of Regan's *G. huttoni.*

Extensive fish collections exist in the New Zealand museums and it is to be sincerely hoped that ichthyologists will be found to utilize them in regional revisons (e.g., like Bolin's 1938 review of West American Myctophidae). In the meantime, Dr. Phillipps' handbook will be of use, especially in connection with his excellent and admirable bibliographical check-list of 1927, and we are especially grateful for its publication in such terrible times as these.—GEORGE S. MYERS, *Stanford University, California.*

THE MATERIAL BASIS OF EVOLUTION. By Richard Goldschmidt. Yale University Press, 1940: i–xi, 1–423, 83 figs., 10 plates, $5.00.—This is a second edition of Dr. Goldschmidt's interesting and provocative book on the thesis that species and higher groups originate, not by the accumulation of micromutations, but in single macro-evolutionary steps as completely new genetic systems. A considerable body of evidence is offered in support of this argument.—LIONEL A. WALFORD, *Fish and Wildlife Service, Stanford University, California.*

SCIENCE AND CIVILIZATION. By Bernard Lovell. Thomas Nelson and Sons, Ltd., New York, 1939: i–x, 1–146, $.75.—The scientific and intellectual resources of Europe, chiefly of Great Britain, Germany, and the U.S.S.R., are reviewed and evaluated in this book. The inevitable conclusion is that mankind undergoes a vast amount of needless suffering, owing to his obstinate refusal to make use of his accumulated knowledge. The remedy which Professor Lovell advocates is Education and more Education.—LIONEL A. WALFORD, *Fish and Wildlife Service, Stanford University, California.*

SALT WATER FISHING TACKLE. By Harlan Major. Funk & Wagnalls Company, New York and London, 1939: i–xiv, 1-278, 84 figs., 64 plates, $5.00.—This is one of those rarest of books: it elucidates the art of salt water angling without sugar. There are chapters on the methods of fishing and on the manufacture of fishing gear which are written in perfectly clear and straightforward style. The book is illustrated with good, pertinent and original drawings, and there are several photographs, of which few are personal.—LIONEL A. WALFORD, *Fish and Wildlife Service, Stanford University, California.*

EDITORIAL NOTES AND NEWS

The 1941 Meeting

THE twenty-fourth annual meeting of the AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS was held in Gainesville, Florida, from Wednesday evening, April 2, through Saturday, April 5. The Board of Governors assembled at 9:15 P.M. April 2, in the dining room of the White House Hotel, with PRESIDENT DYMOND presiding; 14 Governors and 5 members of the Local Committee were present. Following the reading and approval of the 1940 minutes, the PRESIDENT appointed the following committees: *Nominating*—HOWARD K. GLOYD, WALTER H. CHUTE, and A. F. CARR, JR.; *Resolutions*—ALBERT S. HAZZARD, CHARLES F. WALKER, and C. M. BREDER, JR.; *Stoye Prizes*—CLIFFORD H. POPE, and CARL L. HUBBS. The 38 new members secured since the 1940 meeting were formally elected to membership. The following six retiring members of the Board were re-elected to serve until 1946: E. MILBY BURTON, LUIS HOWELL RIVERO, JEAN M. LINSDALE, F. H. STOYE, ARTHUR SVIHLA, and PERCY VIOSCA, JR. The four following new members were elected to the Board to complete the class of 1946: REEVE M. BAILEY, D. D. DAVIS, EDWARD C. RANEY, and JOHN TEE VAN. MALCOLM A. SMITH was elected as a new Honorary Foreign Member to fill the vacancy occasioned by the death of ADOLPHO LUTZ. The SECRETARY reported that the Society had 15 fully paid Life Members and 3 partially paid Life Members on March 31, 1941. On the same date the total sum on deposit in the Endowment Fund savings account was $1689.29. The SECRETARY read invitations for the 1942 meeting from the New York Zoological Society and the American Museum of Natural History; in addition, MR. VIOSCA issued a very cordial invitation to the Society to meet in New Orleans. After careful consideration, the Board voted that the 1942 meeting should be held in New York City under the joint auspices of the two inviting institutions, and that the dates be left to the selection of the Local Committee, with the recommendation that the Society meet jointly with the American Society of Mammalogists if this organization decides subsequently to hold its 1942 meeting in New York. DR. LUIS HOWELL RIVERO, representing the Universidad de la Habana, formally invited the Society to meet in Cuba in 1943. After considerable discussion, it was decided that the invitation of this institution should be accepted with the understanding that, international conditions permitting, the meeting will be held in Havana during the summer or early autumn of 1943. In the event that a Cuban meeting is not feasible, New Orleans is to be considered as an alternative location. The Board voted that the Society should again donate $50.00 toward the publication costs of the *Pisces* and *Amphibia and Reptilia* sections of the *Zoological Record*. It was further suggested that supplies of these sections be ordered by DR. HUBBS and MR. NECKER (or an alternate) for resale to members of the Society so that ease of obtaining copies will induce more members to purchase these sections. The Committee on Memorial Numbers of COPEIA reported that no recommendations had been made to it since the Toronto meeting. The question of limiting speakers to the time allotted to them on the program was discussed and it was decided that the presiding officers at the Gainesville meeting should be instructed to hold speakers to the allotted time. The meeting adjourned at 10:35 P.M.

Sessions of April 3

FOLLOWING the registration of members, PRESIDENT DYMOND called the meeting to order at 10:10 A.M. Professor T. H. HUBBELL introduced DR. JOHN J. TIGERT, President of the University of Florida, who delivered an unusually delightful address of welcome to which PRESIDENT DYMOND responded with his customary facility.

The annual business meeting was called to order at 10:30 A.M. by PRESIDENT DYMOND. The minutes of the last meeting, already published in COPEIA, were dispensed with. Messages of greeting from absentee members were read by the SECRETARY.

The SECRETARY reported that 38 new members were added to the rolls in the period of 7 months since the previous meeting; 2 members died, 5 resigned, 18 were dropped, and 5 were suspended until the end of the war. These changes resulted in a net gain of 8 members, thereby increasing the total membership to 545. Ten new subscribers were

obtained, 4 subscriptions were cancelled, and 4 were discontinued until the end of the war, resulting in a net gain of 2 subscribers and increasing the subscription list to 149. The total number of members and subscribers was 694 on March 31, 1941. A geographical analysis of the members and subscribers indicated that 107 copies of COPEIA go to 22 foreign countries, Canada leading with 32 copies, followed by Great Britain with 15. The domestic copies total 588, distributed in 45 states and the District of Columbia; 95 to New York, 75 to California, and 43 to Michigan, the three leading states. The Society has neither members nor subscribers in Delaware, Idaho, and Nevada.

The SECRETARY further reported that he had completed ten years' service, during which period the total number of members and subscribers increased from 421, in 1931, to 694, in 1941, a growth of approximately 40 per cent which he attributed to the constant coöperation of the members in recommending prospects. The secretarial duties were stated to consist of such routine matters as preparing bills, correcting addresses, and notifying members who have moved to new addresses that their copies of COPEIA went astray because the Secretary lacks powers of clairvoyance. The primary qualification for a good Secretary is that he in turn have a good secretary, and the present incumbent requested that some other member so endowed be selected within the next several years so that the Society may enjoy a secretarial new deal.

In the absence of the TREASURER, the SECRETARY presented a summary of his report for the calendar-year 1940, as follows: Actual credit balance on January 1, 1940, $775.10; total receipts for the year 1939, including contributions toward printing and payments for reprints, $2666.46; expenditures, including $1850.12 for the publishing of COPEIA and $451.45 for the printing of reprints for authors, totaled, $2635.02. The actual credit balance on December 31, 1940, was $786.49.

The HISTORIAN's report was read by the SECRETARY. MR. NECKER stated that the Society files, plus items in his personal collection, now provide over 800 biographies, of which number 20 per cent are accompanied by good photographs, 10 per cent by snapshots, and 15 per cent by bibliographies. Members were requested to return their questionnaires if they have not done so, and to send in additional biographical material for gift or loan to the Society file.

DR. WALKER reported that the Committee on Herpetological Standards was actively continuing its work, and MR. BOGERT reported that the Committee on Postal and Express Regulations was making some progress. No other Standing Committee reports were presented. The SECRETARY gave a report upon the business transacted at the Board of Governors' meeting. The Nominating Committee presented its report and the SECRETARY was instructed to cast a ballot for the following officers: JOHN T. NICHOLS and LEONHARD STEJNEGER, *Honorary Presidents;* JOHN R. DYMOND, *President;* W. J. K. HARKNESS, F. H. STOYE, and C. M. BOGERT, *Vice-Presidents;* M. GRAHAM NETTING, *Secretary;* ARTHUR W. HENN, *Treasurer;* HELEN T. GAIGE, *Editor-in-Chief of* COPEIA; LIONEL A. WALFORD, *Ichthyological Editor;* KARL P. SCHMIDT, *Herpetological Editor;* and WALTER L. NECKER, *Historian.* Following informal discussion of the month in which the proposed 1943 Havana meeting should be held the business meeting adjourned at 11 A.M. The following papers were then presented:

1. **Distribution of two genera of American minnows**—Carl L. Hubbs.
2. **The fishes of Arctic America**—J. R. Dymond.
3. **Ecological study of the fresh-water fishes of Cuba**—Luis Rene Rivas (read by Luis Howell Rivero).
4. **A study of the feeding habits of Gambusia affinis affinis with special reference to its effectiveness in controlling the malaria mosquito, Anopheles quadrimaculatus**—A. D. Hess and C. M. Tarzwell (read by latter).

The afternoon session convened at 2:15 P.M., with VICE-PRESIDENT POPE presiding over an audience of 80, for the reading of the following papers:

5. **Sensory cues used by rattlesnakes in their recognition of ophidian enemies**—C. M. Bogert.
6. **Notes on the courtship of the cotton-mouth moccasin**—A. F. Carr, Jr., and M. H. Carr (read by the latter).
7. **The physiological problem of body fluid regulation**—Homer W. Smith.
8. **A pigmentation gradient as exemplified in Triturus granulosus**—Sherman C. Bishop (read by Arnold B. Grobman).
9. **Water-goggling as a new technique in the study of the habits of turtles**—Lewis J. Marchand
10. **A second record of the family Ateleopidae in Cuba**—Luis Howell Rivero.
11. **Some recent color photographs of reptiles and amphibians**—Harold Trapido.
12. **Pictures of Some Florida cold-blooded vertebrates**—Leonard Giovannoli.
13. **Notes on the frogs of the genus Acris**—M. Graham Netting and Coleman J. Goin (read by latter).

The annual banquet was held in the White House Hotel at 7 P.M. Preprandial excitement was provided by *Ichtherps** and *Dopeia*,* the latter publication presenting for the first time in printed form A. F. Carr's justly famous key to "The Fishes of Alachua County, Florida." Following the banquet MR. ARTHUR MCBRIDE, Curator of Marine Studios, presented his motion pictures of marine vertebrates, including excellent sequences showing the birth of a porpoise.

*Copies may be obtained from the Secretary at twenty-five cents each.

Sessions of April 4

THE morning session was called to order at 10:15 A.M., with VICE-PRESIDENT HARKNESS presiding over an audience of 45, for the reading of the following papers:

14. **Considerations in regard to the males of Heterandria cubensis Eigenmann**—Luis Howell Rivero and Carl L. Hubbs (read by latter).
15. **The intergradation between two subspecies of Gambusia affinis**—Boyd W. Walker.
16. **Two new genera of cyprinid fishes from Nevada**—Robert R. Miller.
17. **The breeding habits of Notropis chalybaeus**—Nelson Marshall.
18. **Some factors in the abundance of certain fishes in Lake Erie**—Kenneth H. Doan.
19. **A preliminary report on the measurement of fishing intensity on T.V.A. Reservoirs**—Clarence M. Tarzwell and Lawrence F. Miller (read by latter).

A group photograph was taken at noon. The afternoon session was called to order at 2:10 P.M., with VICE-PRESIDENT BOGERT presiding, and 60 persons in attendance for the reading of the following papers:

20. **The ambystomas of Florida**—M. Graham Netting and Coleman J. Goin (read by the former).
21. **Geographic variation in Storeria dekayi**—Harold Trapido.
22. **Variation in the keeled green snake, Opheodrys aestivus**—Carl F. Kauffeld.
23. **Reptile and amphibian records for Okeechobee County, Florida**—Carl F. Kauffeld.
24. **The salamanders of the genus Pseudotriton**—Arnold B. Grobman.
25. **A biometrical analysis of two populations of the leopard frog**—Anita E. Daugherty.
26. **Production of snake venom**—E. Ross Allen.
27. **Catching trouble**—E. Ross Allen.

At the conclusion of the afternoon session the Stoye Prizes were awarded to NELSON MARSHALL and ANITA DAUGHERTY for the best student papers presented during the meeting in the fields of ichthyology and herpetology, respectively. MR. TRAPIDO spoke on behalf of a member of the Society, DR. C. C. LIU, West China Union University, who has lost his library through enemy action and who requests duplicate reprints from his American colleagues.

Entertainment on Friday evening consisted of a delightful barbecue supper held at Lake Mize on the Austin Cary Memorial Forest. Well-nigh unbelievable quantities of barbecued kid, beef, pork, opossum, and porpoise were consumed by the hundred-odd persons present. Salad, cake, and coffee were served also, and the members were entertained by a local colored quartet with a program of "spirituals." The herpetologists present enjoyed the latter hours of the evening almost as much for the heavy rains had brought forth a record aggregation of both winter- and spring-breeding frogs.

April 5

THE final day of the meeting was devoted to a tour which started from Gainesville at 7:30 A.M. The first stop was at Silver Springs, near Ocala, where the party viewed the magnificent springs from glass-bottomed and "photo-sub" boats, at a special rate, and visited Ross ALLEN'S Reptile Institute as guests. Mr. Allen demonstrated his efficient snake milking technique and supplied every facility for the examination of his living and preserved specimens. Following the tour, a buffet luncheon, featuring such items as turtle, alligator, and rattlesnake meat superlatively prepared by MRS. ALLEN, was served. In the afternoon the party travelled through the Ocala National Forest, or "big scrub," stopping en route at several points to see *Sceloporus woodi*, endemic plants, and various scenic features. The caravan reached the University Conservation Reserve at Welaka in time to enjoy a fish fry, arranged by DR. O. LLOYD MEEHAN of the U. S. Fish and Wildlife Service. Dr. Meehan's broad biological interests were reflected in the menu, which included "conch" chowder, a number of species of fish, and various local fruits. Following this feast MR. E. ROSS ALLEN presented movies of Florida wild life, which he accompanied with enlightening and, at times "debunking," comments. The herpetologists enjoyed productive collecting in the vicinity of Welaka before returning to Gainesville.

April 6 THE meeting officially closed Saturday evening, but a large number of the delegates journeyed to Marineland on Sunday to participate in a guest tour of Marine Studios arranged by CURATOR ARTHUR F. MCBRIDE. No finer environment in which to part company could have been provided for the interesting animals to be seen through every porthole and the magnificent panorama of ocean and beach did much to lessen the feeling of sadness that comes at the conclusion of every successful meeting.

The papers read at the meeting were of unusual interest and quality. Since the Stoye Prizes were established several years ago a marked improvement in the presentation and content of student papers has been apparent, and the donor of these prizes may take pardonable pride in the evident results of his generosity. The entertainment provided by the LOCAL COMMITTEE more than fulfilled the highest traditions of southern hospitality. There can be no doubt that the Society has benefited immeasurably by holding alternate meetings at points distant from the geographical center of its membership, as those who have been fortunate enough to attend these meetings can testify. The large attendance at Gainesville was tribute to the efforts of the local members and of their associates in the Department of Biology of the University of Florida. Members in attendance numbered 50, families of members 19, and visitors 48, making a total registration of 117. Of this number 34 persons were Gainesville residents, 23 were from other parts of Florida, and 60 were from elsewhere in the United States, Canada, and Cuba.

Some of the credit for the success of the meeting properly belongs to an anonymous member who generously donated the sum of $80.00 to be used to promote attendance. The SECRETARY solicited applications for Grants-in-Aid for travelling from student members, and the TREASURER and SECRETARY awarded four grants to graduate students, at three different universities, who would not have been able to attend the meeting without this assistance.

The RESOLUTIONS COMMITTEE was afforded no opportunity to present its report during the closing hours of the meeting, so the SECRETARY transmitted the following resolution, drafted by this Committee, to the various coöperating institutions and individuals:

Resolved, that the members of the American Society of Ichthyologists and Herpetologists appreciate the warm welcome and gracious hospitality afforded them during the 25th Annual Meeting of the Society held at Gainesville, Florida, April 3 to 5, 1941.

Therefore, the Society wishes to thank the Local Committee, the University of Florida, the Reptile Institute, Marine Studios, and the U. S. Fish and Wildlife Service, for their efficiency in arranging the various meetings and for the bounteous entertainment provided.

M. GRAHAM NETTING; *Secretary*.

Western Meeting THE thirteenth annual meeting of the WESTERN DIVISION, American Society of Ichthyologists and Herpetologists, held at Pasadena, June 18-19, was featured by three symposia and a half-day session of general papers. The program follows:

Wednesday, June 18, 9:30 A.M.

1. **Observations on the breeding habits of the spadefoot toad**—H. T. Woodall.
2. **Growth changes and relationships among pipefishes and seahorses**—E. S. Herald.
3. **Effects of low temperatures on lizards**—S. D. Hinton.
4. **The temperature relations of Xantusia vigilis**—D. R. Wells.
5. **The Zaphlegidae, a family with scombrid relationships restricted to the California territory**—L. R. David.
6. **Adaptations for psammophilous life in the fringe-footed sand lizard, Uma notata**—R. C. Stebbins.
7. **Natural spawning of cutthroat and eastern brook trout**—O. R. Smith.

June 18, 2:00 P.M.

Symposium: Introduced fishes in waters of the Pacific coast.

8. **The general situation and the biological effects of alien species**—B. Curtis.
9. **History and present status of introduced fishes in the fresh waters of California**—W. A. Dill
10. **Alien fishes in waters of northwestern North America**—W. M. Chapman.
11. **Economic appraisal of introduced species**—G. H. Clark.
12. **Problems arising from the transplantation of trout**—O. R. Smith and P. R. Needham.

Thursday, June 19, 9:30 A.M.

Symposium: Rattlesnakes and other pit vipers.

13. **Genera of the crotalidae, with remarks on certain species and characters**—R. Maslin.
14. **Some observations on Trimeresurus**—A. W. Herre.

15. A field study of the Pacific rattlesnake—H. S. Fitch.
16. Speciation in rattlesnakes—L. M. Klauber.
17. Vipers in captivity—C. B. Perkins.

June 19, 1:30 P.M.

Symposium: Africa, zoologically speaking.

18. African backgrounds—B. Willis.
19. Origin and distinction of African mammals—C. Stock.
20. Some remarks on the distribution of African fresh-water fishes—G. S. Myers.
21. Facts from fiction regarding Africa—R. B. Cowles.
22. South and East Africa in color—Sarah R. Atsatt.
23. Zoological reconnaissance in North Africa—A. Van d. Horst.

An extensive exhibit of California fossil fishes was presented by LORE R. DAVID. About 130 persons attended the symposium on Africa and about 60 were attracted to each of the other sessions.

Officers for the ensuing year are: *President,* MARGARET H. STOREY; *Vice-President,* A. M. WOODBURY; *Secretary,* RICHARD S. CROKER. The 1942 meeting will be held at Salt Lake City, Utah.—RICHARD S. CROKER, *Secretary.*

News Notes

DR. HOBART SMITH, holder of the Walter Rathbone Bacon Traveling Scholarship under the Smithsonian Institution during the past three years, has accepted an instructorship in Biology in the University of Rochester for the coming year.

MR. WM. H. STICKEL has been appointed Junior Biologist at the Patuxent Research Refuge, Bowie, Maryland.

The exchange fellowship held by DR. JOSEPH R. BAILEY has been renewed for another year. Dr. Bailey plans to remain in Brazil.

DR. JAMES MOFFETT has accepted a position as Assistant Aquatic Biologist with the U.S. Fish and Wildlife Service. Dr. Moffett's headquarters will be at Palo Alto.

DR. E. B. SHELLEY LOGIER and MR. G. C. TONER have in preparation an account of the distribution of the North American amphibians and reptiles whose ranges extend north of the United States-Canadian border. Canadian, Alaskan, or Labradorean records, and especially such as modify existing knowledge of the distribution of the various forms of amphibians and reptiles at the north, will be very much appreciated by Dr. Logier and Mr. Toner. Reprints of a preliminary check-list published in the *Canadian Naturalist* may be had on application to the authors.

News has just been received of the death of HOWARD WALTON CLARK, Curator of Fishes in the California Academy of Sciences, on August 10. An account of Mr. Clark's life will appear in the next issue of COPEIA.

DR. H. K. GLOYD, director of the museum of the Chicago Academy of Sciences, was the guest speaker of the MISSOURI HERPETOLOGICAL SOCIETY at the Kansas City Museum on the evening of June 2. He showed motion pictures in color and described some of the reptile life of the Southwest. The Missouri Herpetological Society was recently organized to promote the study of local problems on amphibians and reptiles. PHILIP D. EVANS of Kansas City is president. After three days of field work in south-central Missouri with Evans, Dr. and Mrs. Gloyd went to Superior, Arizona, where they spent four weeks collecting reptiles and insects in the vicinity of the Boyce Thompson Southwestern Arboretum.

JOHN D. BLACK has accepted a position at the Alabama Polytechnic Institute, Auburn, Alabama.

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